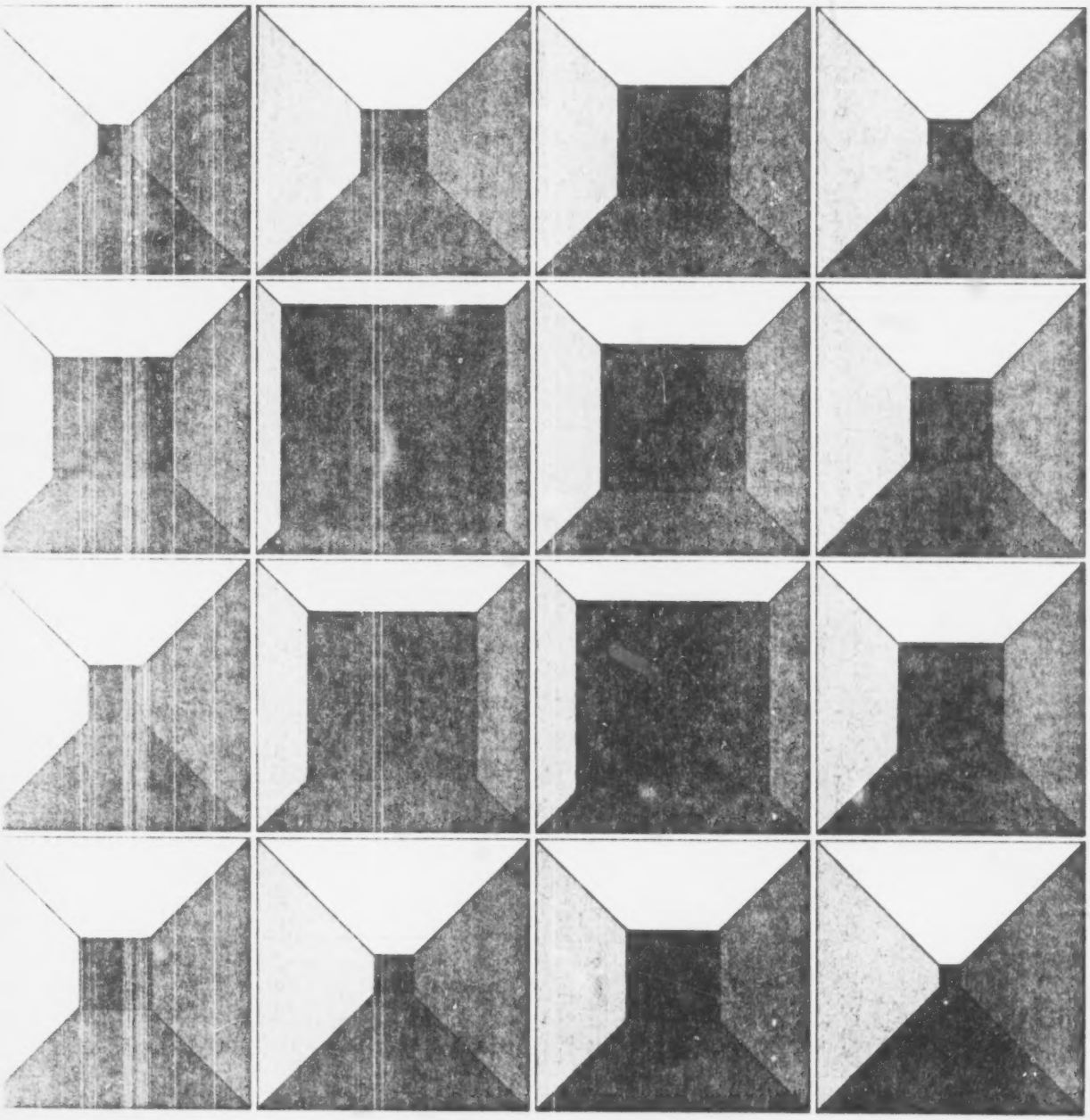
CBO Study

Army Ground Combat Modernization for the 1980s:

Potential Costs and Effects for NATO

November 1982

Congress of the United States
Congressional Budget Office



J932-43

ARMY GROUND COMBAT MODERNIZATION FOR THE 1980s:

POTENTIAL COSTS AND EFFECTS FOR NATO

Congress of the United States
Congressional Budget Office

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

NOTES

Unless otherwise indicated, all years referred to in this paper are fiscal years. Likewise, unless otherwise noted, all dollar amounts are expressed in inflated dollars.

PREFACE

As the Congress considers the defense budget for fiscal years 1983 and 1984, one important issue will be the Army's equipment modernization. The Administration is proceeding with a major investment program to improve ground combat capabilities by upgrading or replacing existing weapons systems. Congressional decisions on these programs will depend on the effects of modernization on the balance of NATO and Warsaw Pact forces and on the money needed to achieve these effects. Prepared at the request of the House Committee on Appropriations, Subcommittee on Defense, this study analyzes these issues. In addition, it analyzes the growth in Army operating costs that would attend modernization, a topic that has been of concern to defense subcommittees in both the Senate and the House of Representatives.

The study was prepared by Nora Slatkin of CBO's National Security and International Affairs Division, under the supervision of Robert F. Hale and John J. Hamre. Extensive assistance was provided by Bill Myers of CBO's Budget Analysis Division, who developed the cost estimates, and by Johanna Zacharias, who edited the paper. Joel Slackman and Julie Carr of the CBO staff also contributed to the estimates of costs. The author gratefully acknowledges the valuable assistance of Bonita J. Dombey, T. Keith Glennan, III, John D. Mayer, Jr., Edward A. Swoboda, and Richard R. Mudge of CBO, and of Major General Patrick M. Roddy (USA, ret.). (The assistance of external reviewers and contributors implies no responsibility for the final product, which rests solely with CBO). Janet R. Stafford typed numerous drafts of the manuscript and assisted in preparing the paper for publication. In keeping with CBO's mandate to provide objective analysis, this paper offers no recommendations.

Alice M. Rivlin
Director

November 1982

CONTENTS

		Page
PREFACE		iii
SUMMARY		xiii
CHAPTER I.	INTRODUCTION	3
	The Perceived Warsaw Pact Threat	3
	The Current Modernization Plan	4
	The U.S. Army Today	5
	Organization of NATO Forces	6
	Prospects for NATO Modernization Under Fiscal Pressures	8
	Plan of the Study	9
	Glossary of Terms	11
CHAPTER II.	ARMY MODERNIZATION IN PERSPECTIVE	15
	Warsaw Pact Force Modernization	15
	Modernization of Non-U.S. NATO Forces	17
	U.S. Army Modernization	20
CHAPTER III.	THE EFFECTS OF MODERNIZATION ON FORCE RATIOS	27
	Measuring the Force Balance	27
	Before Modernization-- The Force Balance as of 1980	29
	The Force Balance After Modernization	31
CHAPTER IV.	OPTIONS	35
	Alternative Approaches For Army Modernization	35
	The Costs of Moving the Force Balance Beyond the Status Quo	43

Contents (Continued)

		Page
CHAPTER V.	LONG-RUN COSTS OF MODERNIZATION--A SELECTIVE ASSESSMENT	49
APPENDIX A.	COMPOSITION OF THE U.S. ARMY	59
APPENDIX B.	METHOD FOR ASSESSING THE IMPROVEMENTS IN FORCE CAPABILITIES	61
	U.S. Weapons Capability	61
	The Modernization of the Warsaw Pact Forces	64
APPENDIX C.	THE MODERNIZATION EFFORTS OF THE NON-U.S. NATO ALLIES	69
	The British Corps	69
	The West German Corps	69
	The Dutch Corps	70
	The Belgian Corps	71
APPENDIX D.	ESTIMATING ARMY FORCE STRUCTURE REQUIREMENTS	72

TABLES

		Page
TABLE 1.	PERCENTAGE OF WARSAW PACT FORCES MODERNIZED THROUGH 1987	17
TABLE 2.	COMPARISONS OF RECENT DEFENSE EXPENDITURES OF NATO MEMBER NATIONS: 1980-1981	18
TABLE 3.	WEAPONS SYSTEMS PROCUREMENT PROFILES: 1979-1987	21
TABLE 4.	EQUIPMENT PROCUREMENT RATES UNDER ADMINISTRATION PLAN, REDUCED PACE OPTION, AND MODIFIED PROGRAM COMPOSITION OPTION, BY WEAPONS SYSTEM: 1983-1987	36
TABLE 5.	COSTS AND COMPLETION DATES OF GROUND COMBAT MODERNIZATION UNDER ADMINISTRATION PLAN, REDUCED PACE OPTION, AND MODIFIED COMPOSITION OPTION	41
TABLE 6.	PROCUREMENT PROFILES THAT WOULD ACCELERATE ARMY MODERNIZATION: 1983-1987	44
TABLE 7.	ANNUAL RECURRING OPERATING AND SUPPORT COSTS FOR TANK BATTALIONS	51
TABLE 8.	ANNUAL RECURRING OPERATING AND SUPPORT COSTS FOR MECHANIZED INFANTRY BATTALIONS	53
TABLE 9.	COMPARISON OF ANNUAL RECURRING OPERATING AND SUPPORT COSTS FOR TANK AND MECHANIZED INFANTRY BATTALIONS	54

11-592 O - 82 - 2

FIGURES

		Page
FIGURE 1.	CORPS SECTORS OF MILITARY RESPONSIBILITY IN NATO'S CENTRAL REGION	7
FIGURE 2.	SHIFTING WARSAW PACT/NATO FORCE BALANCE IN 1980: 90 DAYS FOLLOWING PACT MOBILIZATION	29
FIGURE 3.	EFFECTS OF MODERNIZATION ON FORCE RATIOS IN EUROPE'S CENTRAL REGION 90 DAYS AFTER MOBILIZATION: 1987	32

INTENTIONAL BLANK

SUMMARY

The Warsaw Pact alliance, the principal opponent confronting NATO, has recently made significant gains in conventional ground combat weaponry, and evidence suggests these advances will continue throughout this decade. In response to the growth of the perceived Warsaw Pact threat, all member nations of NATO have committed themselves to programs that would upgrade their own nonnuclear capabilities. Provisions of a NATO agreement signed in 1977 stipulate that each member nation pledge to increase real annual defense spending by 3 percent. Fiscal pressure, especially on Western European governments, has made attainment of that goal difficult, however. Whereas the Congress would prefer to see our allies shoulder a larger share of the burden of defending NATO, economic realities may leave the major responsibility to the United States in the near term, and in particular, to the U.S. Army.

THE ADMINISTRATION PLAN FOR ARMY GROUND COMBAT MODERNIZATION

The U.S. Department of Defense, initially under previous Administrations and now under the Reagan Administration, has formulated plans to make major investments in ground combat materiel for the Army. The ground combat equipment modernization sought by this Administration would improve or displace outmoded weapons systems at a total cost of $37.6 billion over the five-year period 1983-1987. Most of this sum would go to acquire

- 5,096 M1 tanks at a total five-year cost of $13.3 billion,
- 3,897 M2 Fighting Vehicle Systems (FVS) for $8 billion,
- 221 Multiple Launch Rocket Systems (MLRS) for $2.8 billion,
- 435 Apache Attack Helicopters (AH-64) for $5.6 billion, to be equipped with 29,076 Hellfire Missiles, for $1.4 billion,
- 568 Division Air Defense (DIVAD) guns for $3.6 billion, and
- 208 applications of the Army Helicopter Improvement Program (AHIP), which would upgrade existing OH 58 scout/observation helicopters at a total cost of $1.3 billion.

The $37.6 billion would also put two more divisions in the POMCUS program, which prepositions heavy Army equipment in Europe to speed the deployment of divisions stationed in the United States should a war occur. The high cumulative cost of this procurement package (which excludes another $10 billion to be spent for tactical nuclear and other improved capabilities), as well as the tight constraints now affecting the federal budget, have given rise to questions about what gains in defense capabilities the program can buy and how much can be purchased for less.

POTENTIAL EFFECTS OF GROUND FORCE MODERNIZATION

Analysis of the effects of modernization indicates that, by the end of 1987, U.S. Army capabilities will be improved by 35 percent over 1980 levels if the Administration's program proceeds as planned. The West Germans, too, expect to accomplish significant improvements in ground force capabilities. In view of the uncertainties in other allies' modernization efforts, however, the overall NATO-wide force improvement is not projected to exceed 23 percent over 1980 levels. According to the Congressional Budget Office's analysis, if the Pact continues to modernize at current rates, this degree of improvement will keep the ratio of NATO forces to Pact forces roughly even. In other words, even the commitment of $37.6 billion would leave the status quo unchanged. Moreover, under scenarios often used to analyze ground engagements, this status quo might not yield the ratio of forces the Army believes is required for a successful defense.

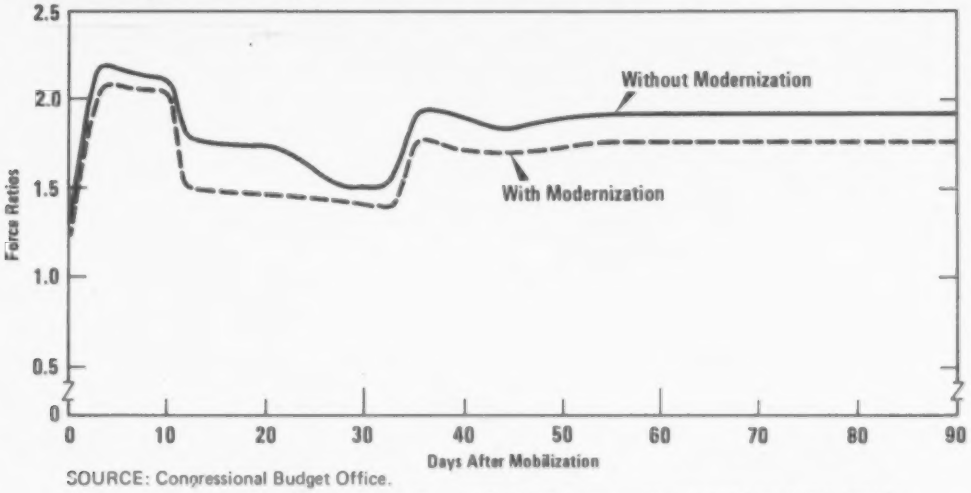
Trends in Force Ratios

The NATO alliance seeks to achieve a military posture strong enough to allow it, should the Pact initiate an attack, to hold the continuous defensive line that it maintains in peacetime. To accomplish this defense, the Army believes that NATO must maintain a ratio of Pact to NATO forces of 1.5:1 or less throughout the European theater. In the local area under attack, the ratio should be 3:1 or lower.

The theater-wide Pact advantage could rise above 1.5:1 at two phases within the first three months after a mobilization. Within the first ten days, a Pact advantage of 1.65:1 could result from NATO's need to move forces from peacetime positions and take up new stations. The arrival of reinforcements from the United States could soon begin to reverse that Pact edge. Within roughly four weeks, however, the Pact forces could restore and retain their initial advantage with the addition of their own reinforcements. A force ratio of roughly 1.7:1 could characterize the buildup from day 40 on (see Summary Figure).

Summary Figure

Effects of Modernization on Force Ratios in Europe's Central Region 90 Days After Mobilization: 1987



SOURCE: Congressional Budget Office.

NOTES: Assumes continuation of Warsaw Pact modernization at current rates and completion of U.S. Administration and West German modernization programs. Includes U.S. augmentation of POMCUS to six division sets.

Results would be worse if the Pact only, and not NATO, continued to modernize. The CBO analysis suggests that, without NATO modernization and particularly, without fortification of the sizable U.S. role, the Pact advantage could grow. The total theater-wide ratio could worsen to 1.9:1.

Assessing Force Effectiveness

This assessment derives from an analysis based on "armored division equivalents" (ADEs), an analytical tool devised by the Defense Department to reflect both numbers and combat qualities of weapons. Being a purely numerical gauge, the ADE cannot illustrate certain but unquantifiable influences such as tactical skill, personnel morale, and weather that can profoundly affect the outcome of a war. In addition, such analysis depends on assumptions that are best guesses, not certainties. The CBO analysis assumes, as the Defense Department commonly does, that NATO could detect a Pact mobilization and would decide to mobilize its forces within four days. The analysis also assumes that the Pact would commit 120 divisions against NATO, about half the divisions now available to the Pact alliance. Another key assumption, which seems particularly uncertain in

light of current political events in Eastern Europe, is that the forces of all member nations of the Warsaw Pact alliance would operate in concert.

COST-CUTTING APPROACHES TO ARMY GROUND COMBAT MODERNIZATION

The size of the federal deficit, currently projected by CBO to be $155 billion in 1983, is prompting consideration of cost-cutting measures in virtually all program areas. The Administration's Army modernization program is no exception. Besides budgetary concerns, uncertainties facing the Pact alliance also lead some observers to believe that less aggressive modernization might be acceptable. Two approaches to the present equipment procurement plan are reviewed below. The Congress could, however, decide that implementation of the full program is essential. Accordingly, three options are first examined:

- Option I--Continuation of current policy,
- Option II--Reduction in the rate of procurement, and
- Option III--Modification of the composition of the program.

The Summary Table presents the financial costs and military effects of these options.

Option I--Continuation of Current Policy (the Administration's Plan)

The investment costs of the modernization program, as stated above, are projected to total $37.6 billion over the next five years, to yield a total improvement in U.S. Army effectiveness of 35 percent. This dollar figure includes the cost of seven major weapons plus $1.6 billion to "preposition" in Europe two additional division sets of equipment under the POMCUS program; four POMCUS division sets are already prepositioned. The effectiveness of this augmentation of POMCUS would be apparent soon after a mobilization, when it could bring Pact/NATO force ratios down from 1.65:1 to 1.48:1. Later, though, the plan would not alter the present conventional balance of forces, assuming the Pact continued to modernize at current rates. Overall force ratios would still remain above the Army's minimally acceptable 1.5:1 level.

Given current economic conditions, the clearest drawback of the Administration's program is its expense. Along with other programs the Army plans, this modernization would require average increases of more than 6 percent a year (after adjustment for inflation) in the Army's procurement budget. In view of the Administration's many other defense

initiatives, this may be a difficult objective to meet. The Army may have to seek as much modernization as possible but at lower costs.

Option II--Reduction in the Rate of Procurement

One approach could be to continue to procure all the weapons systems included in the Administration's plan but at slower rates over the next five years, and to postpone the expansion of POMCUS as well. This would still serve the objective of furnishing the Army with a more capable arsenal, but it would delay completion of the program. As outlined here, this option would limit most procurement to minimum economical production quantities given current or planned production facilities.

The five-year investment costs of this alternative would total $31.4 billion. This represents a savings of $6.2 billion relative to the Administration's program, including $1.6 billion from delaying the POMCUS additions.

The net improvement in ground combat capabilities over 1980 levels would be 32 percent instead of 35 percent--a modest reduction. Foregoing the two additional POMCUS division sets would limit capabilities in the first days following a mobilization. This would be acceptable, however, to military planners who feel that prepositioning two additional division sets would expose too much equipment to possible attack and would limit U.S. flexibility in deploying forces outside Europe.

Another drawback to this option is that the unit costs of equipment would rise, because savings that normally come with production experience would be delayed, and because certain numbers of units would be produced later, when inflation has pushed up costs. Unit costs of the M1 tank, for example, could increase by about 6 percent under this option. Moreover, this option runs counter to one of the Defense Department's key initiatives, which has been to maintain production rates at high levels.

Option III--Modification of the Composition of the Program

Adjusting the program's composition could sustain procurement of several major armor and anti-armor systems at high rates while delaying others to achieve budgetary savings. Those that might be deferred are two that are not ground attack systems--the DIVAD gun and AHIP, which some planners feel warrant lower priority. The Army could, of course, choose to delay other systems and still cut costs. As in Option II, this alternative would also delay the addition of two POMCUS division sets of equipment.

The investment costs of this option would total approximately $31.2 billion--a savings of $6.4 billion over the Administration's plan.

11-592 0 - 82 - 3

Since neither the DIVAD gun nor AHIP is a ground attack system, the effectiveness analysis used by CBO cannot quantify the results of this option in force ratios. But clearly, the Army would risk some reduction in capabilities regarding air defense by not deploying DIVAD, and in aerial target location and designation from its loss of AHIP. The Army would have to rely on weapons now in the force for these missions.

In the case of the DIVAD gun, however, some critics argue that Soviet developments will be able to overcome the gun's capabilities by the time it is fielded. This suggests that relying on existing equipment while better air defense is developed might be acceptable in a period of strict budgetary restraint. In the case of AHIP, the Army could end up putting an expensive modification on an old scout helicopter even though it currently has ongoing a research and development effort for a new scout helicopter that would be ready for procurement in the early 1990s.

THE COSTS OF MEETING MINIMUM OPTIMAL FORCE RATIOS

The Administration's modernization program, and of course the lower-cost alternatives, would fail to meet the minimum 1.5:1 force ratio that Army doctrine regards as preferable. Some observers believe that a substantially greater commitment to conventional forces is necessary. Even though a program that would actually reverse the current Pact advantage seems unlikely in the present economic climate, knowing its costs might prove useful to the Congress.

As a first step toward improving conventional force ratios, the Congress could modernize Army forces at the maximum rates possible with current or planned facilities. This approach would also proceed with the Administration's plan for POMCUS expansion. These steps alone, however, would still not permit NATO to meet the desired 1.5:1 ratio.

To do so, the United States would also have to add two fully supported armored divisions, increasing the Army's active divisions from 16 to 18. The other NATO allies, too, would have to make proportionate increases in the size of their forces. Moreover, they would have to embark on aggressive modernization programs to improve the firepower of their existing divisions to levels consistent with those in U.S. divisions.

Such rapid modernization on the part of the United States, plus the addition of two armored divisions, would be expensive. Over the next five years, the total investment costs (taking into account only the weapons systems considered here) would equal $45.6 billion--some $8 billion more than the Administration's plan. Since it would be impossible with current

SUMMARY TABLE . COSTS AND COMPLETION DATES OF GROUND COMBAT MODERNIZATION UNDER THREE OPTIONS

Total Costs 1983-1987 (In billions of dollars)	Pace of Modernization a/ System	Percent Modernized Through 1987	Year When Modernization Complete	Percent Improvement in Overall Force Capability
	Option I. Administration Program			
37.6	M1 Tank	96	1988	35
	FVS	63	1990	
	MLRS	100	1986	
	AH-64	37	1995	
	DIVAD Gun	100	1987	
	AHIP	36	1991	
	Option II. Slowed Pace of Procurement			
31.4	M1 Tank	75	1990	32
	FVS	52	1993	
	MLRS	100	1986	
	AH-64	37	1995	
	DIVAD Gun	86	1988	
	AHIP	36	1991	
	Option III. Modified Program Composition			
31.2	M1 Tank	96	1988	b/
	FVS	63	1990	
	MLRS	100	1986	
	AH-64	37	1995	
	DIVAD Gun	0	1992 and beyond	
	AHIP	0	1992 and beyond	

SOURCE: Congressional Budget Office.

a. Requirements are based on CBO estimates.

b. Force effectiveness analysis, which reflects ground attack systems only, yields no numerical result from this option, which would defer procurement of AHIP and DIVAD gun.

or planned facilities to carry out a rapid modernization and equip two new divisions by the end of 1987, an additional $4.5 billion would be needed in 1988 and 1989.

Over the next five years, another $17 billion would be associated with basing and operating the two new divisions. Base construction would cost $4.7 billion. Adding the needed 100,000 more troops would cost $6.7 billion, assuming that the increases were phased in at steady annual rates. This amount would cover not only pay and allowances, but also additional recruiting incentives needed to get more recruits while keeping recruit quality high in the all-volunteer force. Finally, the costs of supplies and other operating expenses would total $5.6 billion over the five-year period.

LONG RUN COSTS OF MODERNIZATION--SUPPORT AND MAINTENANCE

The full costs of the Administration's modernization program include not only the investment costs that are the main focus of this study but also the costs to operate and support the new equipment once it is fielded. In general, greater sophistication generates higher maintenance and support costs. Though less visible than the procurement costs, these expenses could increase the Army's future operating budget substantially. Projected increases in the consumption of fuel and of more expensive repair parts play a large part.

With the fielding of the M1 tank--rather than its predecessor, the M60A1--the cost to operate and support a tank battalion is estimated to increase by as much as 41 percent. As the FVS is introduced, the cost to operate and support the mechanized infantry battalion is estimated to increase by as much as 59 percent. In most cases, the CBO has used data consistent with the Army budget to project the recurring costs to operate and support the modernized tank and mechanized infantry battalions. The Army, however, uses other data and assumptions, and it concludes that the increase in costs would be somewhat lower.

By the end of the five-year projection period, the annual cost (in 1983 dollars) to operate and support these modernized tank and mechanized infantry battalions would increase by $1.1 billion. When all of the tank, mechanized infantry, and support battalions are modernized, the added annual costs could total approximately $1.5 billion. By 1987, this represents an increase of 46 percent above the $2.4 billion spent today to operate these battalions, but an increase of only 6.5 percent above the Army's total 1983 budget request for operations and maintenance.

ARMY GROUND COMBAT MODERNIZATION FOR THE 1980s: POTENTIAL COSTS AND EFFECTS FOR NATO

CHAPTER I. INTRODUCTION

In the judgment of the U.S. Department of Defense, the member nations of the Warsaw Pact--principally, the Soviet Union--possess certain critical military advantages over the NATO alliance. [1] Not only do Pact ground troops vastly outnumber NATO's; Pact equipment is also held to be superior in both quality and quantity. Whereas much of the Soviet materiel now deployed was designed and built as recently as the late 1970s with high technological sophistication, most of the equipment the United States now has dedicated to the defense of Western Europe dates back to the early 1970s and even the 1960s.

THE PERCEIVED WARSAW PACT THREAT

Defense Department planning rests on the assumption that the forces of the Warsaw Pact pose the only significant threat to NATO. What combination of factors might prompt the Pact nations to launch an attack against NATO is unclear, but in the view of the Defense Department, the risk requires that NATO be prepared to perform effectively in the most demanding military scenario. Furthermore, NATO may be concerned about the role of military power in discouraging any attempt on the Soviets' part to expand their political influence, both in Europe and elsewhere.

Since the mid-1970s, however, the balance of conventional forces in the Central Region of Europe has become increasingly unfavorable to NATO because of gains in Warsaw Pact strength. These improvements include continued modernization of ground combat equipment and increases in the existing force structure. Those developments have spurred U.S. efforts to update major Army combat equipment. A goal of several previous Administrations, Army modernization first took material form under President Carter with the procurement of several new weapons systems in 1978.

---

1. The 16 member nations of NATO are Belgium, Canada, Denmark, the Federal Republic of Germany, France, Great Britain, Greece, Iceland, Italy, Luxembourg, Norway, Portugal, the Netherlands, Spain, Turkey, and the United States. The seven members of the Warsaw Pact are Bulgaria, Czechoslovakia, the German Democratic Republic, Hungary, Poland, Romania, and the Soviet Union.

THE CURRENT MODERNIZATION PLAN

Continuing this course, the Reagan Administration has committed substantial resources to a major program to improve the effectiveness of the U.S. Army's combat forces by procuring nine major new weapons systems. Though secondary concerns in the Middle and Far East also motivate the Administration's modernization effort (non-NATO contingencies were also key in the previous Administration's defense planning), the primary concern focuses on the military balance in Europe and on defending NATO. The total cost for major systems in the modernization program, if it is fully implemented and completed within the time envisioned, is estimated by the Administration to be $46 billion over the fiscal year 1983-1987 period. 2/

In view of the size of this fiscal commitment, the extreme constraints now affecting the federal budget, and the presumed urgency of the Army's need, the design and costs of the Administration's program warrant assessment. What would the program accomplish? Would it effectively meet its stated goals? Could the same--or at least adequate--effectiveness be purchased for any significantly smaller sum? And at the same time, were the federal budget not so hard pressed, what would be entailed setting even higher standards for NATO's defense?

The scope of this Congressional Budget Office study, intended to help weigh military commitments against capabilities, is confined to seven of the nine proposed new weapon systems--those that would serve U.S. Army ground forces in conventional (that is, nonnuclear) combat mainly in Europe. Procurement costs of these systems (including one missile) have been set by the Administration at $36 billion over the five-year period examined. (The $10 billion difference is accounted for by procurement of an air defense missile system and two helicopter programs not considered in this study. The Army is also developing a missile system as part of the tactical nuclear force modernization program; the details and costs of this program are classified secret for reasons of national security.)

Of course, implementation of an arms control agreement would significantly alter NATO's security concerns. Force reductions in Europe, such as those being considered in the ongoing Mutual and Balanced Force

---

2. This analysis assumes a lag of up to 24 months between the time a weapon is ordered and its delivery--commonly referred to as the funded delivery period. The $46 billion estimate represents the cost of major weapons systems included in the Defense Department's Selected Acquisition Report of June 30, 1982. This estimate excludes the costs for the Copperhead projectile, which was cancelled, and the Pershing II missile system.

Reductions (MBFR) negotiations, would accomplish an important step in enhancing NATO's security, so long as the current imbalance of forces is not codified. Such reductions, coupled with limits on the pace of Warsaw Pact modernization, clearly would lessen a perceived urgency for U.S. Army modernization.

THE U.S. ARMY TODAY

Though the United States must be prepared to meet challenges in such distant theaters as the Persian Gulf or Korea, the defense of Europe remains the cornerstone of U.S. national security policy. 3/ Together with those of other NATO allies, the United States' forces are conceived as a deterrent against attack by the Warsaw Pact forces. Should deterrence fail, however, all 16 member nations of NATO are pledged to regard an attack on one as an attack on all. Accordingly, each member is committed to assign defense forces to the NATO military command if a war should occur. Contributing to the defense of Europe, therefore, remains the Army's primary mission.

Manpower Configurations

To meet its commitments, the Army currently has approximately 784,000 troops on active duty and another 686,000 reserve personnel. Army personnel on active duty are organized into 16 divisions, each of which usually consists of 16,000 to 18,000 troops. There are also separate brigades and regiments, most of which have 4,000 to 5,000 troops. These combat divisions are complemented by numerous support forces ranging from maintenance and support units to medical units. (Appendix A gives a detailed review of the Army's organization.)

In addition, the Army has 686,000 reserve personnel who drill regularly either in the Army National Guard or the Army Reserve. The reserves are organized into eight divisions plus many separate brigades and smaller units.

---

3. The establishment under the Carter Administration of the Rapid Deployment Force (RDF)--with 100,000 troops to be available from all services--reflects increasing concern about requirements for military operations outside of Europe. Since no new combat forces are now planned for the RDF, the existing reservoir of forces would be drawn upon in the event of a non-NATO action. Thus, should the RDF be dispatched to Southwest Asia, for example, these ground troops would be unavailable for simultaneous combat in Europe.

11-592 0 - 82 - 4

Consistent with the U.S. commitment to the defense of NATO, the Army deploys in Europe four divisions, four brigades, and two armored cavalry regiments. (Three of these four brigades are affiliated with active-duty divisions in the continental United States.) Including support forces, there are about 215,000 active Army troops in Europe. Should war erupt in Europe, those units would be reinforced by 11 active-duty and eight National Guard divisions, as well as separate brigades and armored cavalry regiments coming from the continental United States.

Ground Force Materiels

Ten of the Army's divisions and some of the separate brigades are armored or mechanized infantry units (see Appendix A). These units have the majority of tanks and other heavy equipment and will receive most of the new fighting equipment under the modernization program. Though few reserve units will receive new equipment purchased under the modernization program, they will receive the equipment that is replaced in the active units and will thus gain from force modernization.

Several major types of combat equipment are contained in a U.S. armored division. For example, the weapons and tracked combat vehicles include approximately 360 tanks, 500 armored personnel carriers, 108 antitank missiles mounted on vehicles, 24 air defense guns, and 66 pieces of self-propelled artillery (the latter consists of 54 self-propelled 155-millimeter howitzers and 12 self-propelled eight-inch howitzers). The aviation assets of an armored division include 42 attack helicopters, 56 scout/observation helicopters, and 45 transport helicopters. A mechanized infantry division contains all of the same types of combat equipment as an armored division. The quantities of weapons and tracked combat vehicles differ, however. For example, a mechanized infantry division contains 306 tanks, 570 armored personnel carriers, and 126 antitank missiles mounted on vehicles.

ORGANIZATION OF NATO FORCES

The U.S. Army would not, of course, be alone in defending the Central Region of Europe. Some 980,000 active ground forces and more than 900,000 reserves from other NATO nations would join them in combat. The organization of NATO's defensive forces are shown in Figure 1.

The areas of responsibility of NATO's Central Region are defined by two Army groups, each of which is subdivided into four corps sections. Each corps section consists of at least two divisions. In the Northern Army Group (NORTHAG), Belgium, the Federal Republic of Germany (West Germany), Great Britain, and the Netherlands each contribute a corps-sized force. The Central Army Group (CENTAG) is composed of two West German and two U.S. corps. Though not assuming responsibility for the

Figure 1.
Corps Sectors of Military Responsibility in NATO's Central Region

SOURCE: Adapted by CBO from Richard Lawrence and Jeffrey Record, *U.S. Force Structure in NATO* (Washington, D.C.: Brookings Institution, 1974), p. 31 and also from U.S. Army materials.

NOTE: NORTHAG (Northern Army Group) and CENTAG (Central Army Group) are the two subdivisions of NATO forces in West Germany. The line dividing the two runs from Belgium through West Germany, just south of Bonn, and into East Germany.

defense of any individual corps section, the other NATO members (such as Luxembourg and Canada) could contribute forces as part of NATO's strategic reserve or in defense of their national borders against a Pact attack. (In other words, Danish forces would defend Denmark.) France would presumably contribute forces as well, even though it is not a participant in NATO's military council, because it maintains three armored divisions in West Germany.

In the event of war, the divisions stationed in NORTHAG and CENTAG would be reinforced by units coming from the various NATO member nations' home bases. Of all NATO reinforcements, one-third would come from the United States; the Department of Defense has therefore implemented a program to speed the deployment of some of these reinforcements without actually stationing the requisite personnel abroad. This program, which provides storage for "prepositioned" military equipment in Europe for U.S.-based reinforcing units, is known as POMCUS (for Prepositioned Overseas Materiel Configured to Unit Sets). 4/ At present, enough equipment--four "division sets"--is prepositioned in Europe to support speedy deployment of four U.S. Army divisions. As part of a commitment to strengthen NATO, the Administration plans to increase to six the number of divisions with equipment prepositioned there. The initiative to enhance allied reinforcement capabilities--by expanding the number of division sets in POMCUS--is a part of the Long-Term Defense Program (LTDP) agreed to in 1978 by the NATO allies. 5/

PROSPECTS FOR NATO FORCE MODERNIZATION UNDER FISCAL PRESSURES

As it is now designed, the Army's current modernization program would spend about $46 billion over the next five years. Purchases of many of the proposed new systems are already under way. (Data for procurement of some of the systems therefore date back to 1979.) Since "buys" of some systems will continue well beyond the next five years, the eventual commitment of resources will ultimately far exceed $46 billion.

---

4. For more information on the POMCUS program, see for example Congressional Budget Office, Strengthening NATO: POMCUS and Other Approaches (February 1979), and Costs of Prepositioning Additional Army Divisions in Europe (August 1980).

5. The LTDP was formalized by NATO in 1978. Major initiatives include reinforcement as well as improvements in readiness, reserve mobilization, maritime posture, air defense, command and control, logistics, and theater nuclear modernization.

The Army may have trouble affording all of this program, however, and the Congress continues to show concern over the growth of both the procurement and operating costs of Army weapons. In enacting the First Concurrent Resolution on the Budget for Fiscal Year 1983, the Congress reduced the overall defense budget authority by about 4 percent, as part of a package of spending cuts and tax increases designed to reduce the federal deficit and improve the state of the U.S. economy. Further reductions are possible. Nor are budgetary problems in the United States the only factors that could affect modernization.

The Congress has expressed concern that the allies are not spending enough on defense. In response to perceived weaknesses in NATO's defense vis-a-vis the Warsaw Pact's, each NATO member agreed to seek 3 percent annual real growth in defense outlays over the five-year period 1978-1983. In May 1981, the NATO allies reaffirmed their commitment to meeting the 3 percent goal. Though some members had a measure of success in achieving this target, the additional expenditures have not readily translated into major improvements in NATO forces (see also Chapter 2).

Alternative Approaches for U.S. Modernization

In light of these concerns, this study analyzes the effects of two alternatives to the Army's modernization program that would reduce its cost. The first approach would lower costs by slowing the buys of major weapons systems, a course often taken in past years. The second would indefinitely defer purchase of a few weapons systems in order to continue buying others at rapid rates. The latter strategy would be more consistent with recent Defense Department initiatives that stress the need to buy weapons at economical rates.

Under some assumptions, however, both of these reduced programs would fail to give NATO the preponderance of forces that Army doctrine and defense policy suggest are needed. Indeed, even the Army's full modernization program would not provide adequate forces under these assumptions. Thus this study also evaluates the cost of speeding up the Army modernization program and of adding additional Army troops. These estimates provide a benchmark for judging the costs of meeting ground force requirements under militarily more pessimistic assumptions--even though these alternatives may be impracticable in this period of fiscal austerity.

PLAN OF THE STUDY

Chapter II details the Administration's modernization program; it also reviews efforts in other NATO countries and identifies assumptions about the programs in the Warsaw Pact. Chapter III analyzes the effects of these

programs on the force balance in Europe. On these bases, Chapter IV considers the costs and effects of alternative modernization programs.

This study focuses on procurement costs, but the Army may also face problems paying the bills to operate these new weapons. Though the Army's share of the total Defense Department budget has remained constant at about 24 percent, the proportion of Army money spent on investment (that is, procurement, research and development, and military construction) has risen from an annual average of 27 percent in the 1970s to almost 40 percent in the proposed 1983 budget. If reductions in defense spending are made in the operating accounts, this could make supporting new equipment adequately especially difficult. A full investigation of this problem is beyond the scope of this study, but Chapter V does estimate the operating costs of two of the most important new Army systems, the M1 tank and the Fighting Vehicle System. (A glossary, on the following pages, explains these and other terms used in this paper.)

GLOSSARY OF TERMS

Weapons in the current U.S. modernization program analysed in this paper:

M1 Tank. The Army's newest tank, the M1 will replace the current M60 series tank (built mostly in the late 1950s and early 1960s). The M1 is equipped with a 105-millimeter gun and incorporates special armor, a laser rangefinder, integrated sight, and a 1,500 horsepower turbine engine. The tank has been in production since fiscal year 1979, and fielding began in 1981. Future plans include the incorporation of a 120-millimeter main gun in the mid-1980s.

M2 Fighting Vehicle System. Also called the Bradley Fighting Vehicle, the FVS will replace the current M113 armored personnel carrier. The FVS has special armor and a thermal sight. The two-man turret mounts a 25-millimeter cannon and also carries a TOW (defined below) antitank guided missile. Initial production began in fiscal year 1980, and fielding is scheduled for early 1983.

Multiple Launch Rocket System. An artillery rocket system, the MLRS will complement cannon artillery. The MLRS is designed to counter enemy artillery or air defense. It can deliver 16 warheads that carry conventional submunitions. Procurement of MLRS began in fiscal year 1980, and current plans call for the fielding of the system in the early 1980s.

AH-64 Apache Helicopter. The Army's newest attack helicopter, the AH-64 will replace the current Cobra gunships that carry eight TOW (defined below) antitank missiles. It will be the Army's primary airborne antitank weapon and will permit a two-man crew to attack in darkness and in adverse weather. The primary armament on the AH-64 is 16 Hellfire antitank missiles (defined below), which can home in on a target designated by a laser beam. The AH-64 also carries a 30-millimeter chain gun and 2.75-inch rockets. Production began in fiscal year 1982, and fielding is scheduled for the mid-1980s.

Hellfire Missile. Designed to be carried on the AH-64 (see above), the Hellfire homes in on a target that has been designated by a laser

(Continued)

beam; this designation can be done by other aircraft as well as by ground observers. Current plans call for a "follow-on seeker" that will permit the missile to find its target without any external designator--a "fire and forget" capability. The Hellfire is scheduled to be deployed with the AH-64.

Army Helicopter Improvement Program. Designed to modify the current OH 58 scout/observation helicopters that conduct reconnaissance and find targets, and direct attacks, the AHIP will provide both day and night capabilities. It will also increase the helicopter's operational capability. The AHIP currently is in development, and production is scheduled for fiscal year 1984.

Division Air Defense Gun. Designed to provide the Army's forward combat units with low-altitude air defense coverage, the DIVAD gun will replace the current Vulcan air defense gun. Whereas the Vulcan has a 20-millimeter gun with an effective range of two kilometers, the DIVAD is a twin 40-millimenter gun with an effective range of four kilometers. Production of the DIVAD began in fiscal year 1982, and the first systems are scheduled to be deployed in the mid-1980s.

* * * * * * * * * *

Other weapons:

Tube-Launched Optically-Tracked Wire-Guided (TOW) Antitank Missile. To be carried on the FVS (see above), the Cobra Attack Helicopter, and the Improved TOW Vehicle, this missile's warhead can penetrate (from the front) the majority of the world's main battle tanks. It has an effective range of 3,000 meters. Once launched, it must be guided by a gunner, who maintains the crosshairs of the sight on the target. As the gunner tracks the target, a computer in the launcher sends corrections to the missile through fine wires. The TOW missile has been in the Army's inventory for many years; current plans call for improvements in the lethality of the warhead. A French-built equivalent of the TOW missile is the HOT--for Haut Subsonique Optiquement

(Continued)

Teleguide Tire d'Un Tube--missile, which is standard equipment in the French and West German armies.

Leopard II Tanks. A specially armored tank, the Leopard II is the latest version of the West German main battle tank; it is to replace the current Leopard I tank. The Leopard II tank has a 120-millimeter main gun, an integrated laser rangefinder, and thermal image unit. Production began in 1979, and by 1982, the annual production rate is assumed to be 300 tanks.

T-80 Tank. The latest version of the Soviet (hence Warsaw Pact) main battle tank, the T-80, will replace the current T-72 built in the early 1970s and the T-64 built even earlier. The T-80 is believed to have a 125-millimeter main gun, an automatic loader, and laser rangefinder. A major improvement relative to the T-72 may be the tank's special armor.

BMP. A Soviet-built armored fighting vehicle, the BMP is equipped with a 73-millimeter automatic-loaded gun that will fire a High Explosive Anti-Tank (HEAT) round. The BMP has been in production since the late 1960s, and it is deployed in significant numbers in Warsaw Pact armies.

HIND E. A Soviet-built attack helicopter, the HIND E is equipped with a large caliber machine gun and 57-millimeter rockets. It is believed to have a "fire and forget" missile with a range of eight kilometers. The HIND armed helicopter has been deployed since 1974 in Warsaw Pact armies.

11-592 O - 82 - 5

CHAPTER II. ARMY MODERNIZATION IN PERSPECTIVE

The Warsaw Pact nations' recent gains in conventional military equipment are a major force motivating NATO's current drive to upgrade its ground combat materiel. The result of continuing Pact improvements is a gap in military power that NATO modernization efforts now just taking shape are designed to close. 1/ This chapter therefore gives an overview of the status quo, focusing on

- Recent and ongoing Pact achievements,
- The responses of the NATO members, especially as manifested in national commitments to defense spending, and
- The United States' response in particular, as articulated in the Reagan Administration's modernization program for the Army.

Because the U.S. role in the defense of NATO remains large despite concerns in other parts of the globe and despite efforts on the part of the allies to shoulder a larger part of the burden than they have in the past, this chapter details systems comprised in the Administration's initiative, their combat capabilities, and their costs.

WARSAW PACT FORCE MODERNIZATION

If the Warsaw Pact nations continue to produce equipment at the rapid rates that have been observed in recent years, the majority of the existing forces that could confront NATO will be modernized by the late 1980s. In fact, in almost every major category of conventional weaponry, U.S. Army managers believe that the Soviet Union has already fielded a system that is qualitatively superior to its present U.S. counterpart. For example, not only has the Pact already fielded more than 7,000 new T-64 and T-72 tanks in the Central Region in the past five years; it also is

1. In part, this is a result of fundamental differences in each side's approach to equipment modernization. The Soviet Union has demonstrated a preference for the introduction at regular intervals of new equipment that incorporates relatively minor changes. The United States, on the other hand, devotes a significant amount of time in the research and development phase in order to field new equipment incorporating major technological advances.

developing the T-80 tank, which military analysts regard as having better speed and armor than the current T-64 and T-72 tanks and is thought to be the equal to the United States' counterpart, the M1 tank (see the glossary in Chapter I for details on these systems). Included also in the Pact's inventory are an armored fighting vehicle (the BMP), which is equipped with a 73-millimeter automatic-loaded gun and an attack helicopter (the HIND), which is reported to carry four laser-homing tube-launched antitank missiles with an estimated range of eight kilometers. 2/ The one category in which parity is considered to exist is the field artillery cannon. 3/

Table 1 shows the procurement ("buy") rates for the Pact weapons assumed in this study and the percentage of NATO-oriented forces that could be modernized through 1987 at these rates. The percentages assume that all modernization is focused on the 120 Warsaw Pact divisions that might be devoted to a NATO conflict. This modernization could increase the capability, measured in terms of firepower, of the NATO-oriented portion of the Pact forces by approximately 26 percent over the 1980 level. 4/ (Appendix B provides the details of this analysis.)

Not only have Pact nations been modernizing their equipment. The Soviets in particular have been expanding their combat forces in both tanks and artillery. Recent reports indicate that the Soviets have added an artillery battalion to the tank regiments of both tank and motorized rifle divisions, have added tanks to the reconnaissance battalions, and have expanded the motorized rifle companies to battalion-sized units within tank regiments of tank divisions. When complete, these changes will add more than 1,000 artillery pieces and more than 1,200 tanks and armored personnel carriers to the Soviet forces stationed in Europe. 5/

---

2. See Jane's All the World's Aircraft 1978-79, pp. 190-192.

3. See Department of Defense Authorization for Appropriations for Fiscal Year 1982, Hearings Before the Senate Committee on Armed Services, 97th Congress, First Session, p. 1,180.

4. As used here, "firepower" means the ability to deliver heavy ordnance and explosives on enemy forces. The firepower assets examined in this study include tanks, armored fighting vehicles, artillery, antitank guided weapons (ATGW), and attack helicopters.

5. See U.S. Department of Defense, Soviet Military Power (1981), p. 30, and Richard Burt, "Soviets Said to Add to Its Bloc Troops," New York Times (June 8, 1980).

TABLE 1. PERCENTAGE OF WARSAW PACT FORCES MODERNIZED THROUGH 1987

Category of Weapons	Recent Annual Production Rates	Percent
Tanks a/	3,260	74
Armored Personnel Carriers	2,500	59
Artillery (Self-Propelled)	700	38
Attack Helicopters	180	610 b/

SOURCES: Compiled by CBO from various sources, including U.S Department of Defense, Soviet Military Power (Fall 1981), pp. 12-13; Jane's All the World's Aircraft, 1980-81, pp. 202-203; Jane's Armor and Artillery, 1981-1982, pp. 403-405.

NOTE: This table assumes that the Warsaw Pact is adding force structure as well as modernizing such equipment as tanks and attack helicopters. The analytical baseline force is the 1976 structure.

a. Includes T-72 and some T-80 tanks by 1987 funded delivery period.

b. The Pact has made major additions to its attack helicopter fleet. In 1976, the Pact maintained approximately 300 attack helicopters in its inventory. By 1987, its inventory should exceed 2,200 helicopters, assuming that it can continue to produce roughly 15 HIND helicopters a month.

MODERNIZATION OF NON-U.S. NATO FORCES

Awareness of the Pact's growing ground force advantage prompted the NATO allies to adopt the Long-Term Defense Program in 1978. Under the program, all the NATO allies have committed themselves to working toward an alliance-wide force improvement. Each nation has pledged to try to meet a goal of real annual growth in defense spending of 3 percent. Within NATO, the United States devotes the largest share of its Gross National Product (GNP) to defense spending. Even taking account of the uncertainties in estimating the Soviet Union's defense expenditures, its share of GNP devoted to defense still exceeds that of the United States.

The European NATO members' success in meeting the 3 percent real growth goal has thus far been uneven. Recent economic difficulties have diminished the chances of many nations' achieving the target by 1983; to date, most of the European allies have fallen short of this objective (see Table 2). At the same time, however, the United States' growing concern with non-NATO interests--mainly Middle Eastern--has made the other allies' role in defending NATO increasingly important.

TABLE 2. COMPARISONS OF RECENT DEFENSE EXPENDITURES OF NATO MEMBER NATIONS: 1980-1981

Country	Defense Spending as a Percent of GNP in 1981	Real Growth in Defense Spending 1980-1981 (Percent Change)
Belgium	3.3	0.2
Canada	1.7	3.0
Denmark	2.5	0.1
Federal Republic of Germany	4.3 a/	1.9 to 3.4 b/
France	4.1	3.5
Great Britain	5.4	2.1
Greece	5.7	5.6
Italy	2.5	-1.2
Luxembourg	1.2	7.1
Netherlands	3.4	2.3 to 3.4 b/
Norway	3.3	2.5
Portugal	3.8	2.8
Spain	1.9	c/
Turkey	4.5	3.1
United States	6.1	5.4

SOURCES: Compiled by CBO from data in International Institute of Strategic Studies, The Military Balance 1982-83; and U.S. Department of Defense, Report on Allied Contributions to the Common Defense (March 1982), p. 77.

a. Includes expenditures in West Berlin.

b. A range is provided to accommodate two sets of deflators. The lower number assumes the use of a Defense Department estimate; the higher number assumes the use of the country's economic deflator.

c. Spain joined the NATO alliance in May 1982 and has not therefore established a record for fiscal commitment to NATO's defense.

As part of the concerted effort to strengthen NATO's defense, each of the allies has announced equipment modernization programs for their ground forces. Over the next five years, the progress will probably be mixed. The West German and Dutch efforts will enhance armor and anti-armor capabilities. Britain's program is aimed at that nation's major weaknesses--tanks and artillery. The Belgians, on the other hand, will modernize only their fleet of armored personnel carriers. (Appendix C reviews briefly some of the current non-U.S. NATO conventional capabilities and the announced modernization programs.)

From a NATO perspective, the modernization efforts of the West Germans are most significant, since they could contribute up to 50 percent of the non-U.S. NATO forces available. Relative to the republic's 1980 force, modernization will yield an increased capability of almost 25 percent by 1987. 6/ Most of the improvement in West German firepower is derived from the fielding of the Leopard II tank, which is armed with a 120-millimeter smooth-bore gun. Assuming that the current West German program is fully implemented, approximately 76 percent of all armored battalions will be equipped with the Leopard II by 1987. 7/ In addition, the force is to be improved by procurement of the FH-70 155-millimeter towed howitzer, purchase of additional PAH (Panzerabwehr Hubschrauber 2) antitank helicopters, and the refitting with HOT (Haut Subsonique Optiquement Teleguide Tire d'Un Tube) missiles of most of vehicle-mounted antitank weapons systems.

Despite improvements in certain areas and dedicated efforts to increase defense spending as a share of the allies' GNP, however, a large part of the responsibility for NATO's defense will continue to rest with the U.S. Army. In fact, many proponents of the Administration's plan point to it as possibly giving an incentive to other member nations to boost their commitments to the NATO alliance.

---

6. This estimate is based on the same methodology used to quantify the improvements to U.S. forces: measuring the change in effectiveness as a result of performance characteristics within each weapons category and the quantity to be fielded. See Appendix B for details.

7. For fiscal year 1982, no real growth was programmed for the West German military budget. A report published by the West German defense ministry stated that "real growth rates for the defense budget are not to be expected and that some weapons programs will not be carried out." See John Vinocur, "Study by Bonn Foresees Trouble for the Military," New York Times (February 9, 1982), p. 12.

U.S. ARMY MODERNIZATION

The present Administration has proposed, in its February 1982 budget submission, to procure sizable numbers of new armor and anti-armor systems and to proceed with certain other new weapons already under development. Six specific systems (listed below, with numbers of units to be procured by the end of 1987) are considered in this study:

- o M1 Tank--6,729
- o M2 Fighting Vehicle System (FVS)--4,997
- o Multiple Launch Rocket System (MLRS)--333
- o Apache Attack Helicopter (AH-64)--446
  to be equipped with the Hellfire Missile--29,756
- o Division Air Defense (DIVAD) gun--618
- o Army Helicopter Improvement Program (AHIP)--208

In some cases, new systems will replace existing ones; in others, they will provide totally new capabilities. [8]. Table 3 displays the rates at which these systems are to be purchased. The following informal table displays the percentages of Army assets to be modernized by 1987.

Force or fleet	Weapons System	Percentage of Force Modernized by 1987 [a]
Tanks	M1 Tank	96
Armored personnel carriers	FVS	63
Artillery rocket systems	MLRS [b]	100
Attack helicopters	AH-64	37
Air defense guns	DIVAD gun	100
Scout helicopters	AHIP	36

a. Requirements assume 15 active divisions configured with Division 86 Table of Organization and Equipment (TO&E), training base, maintenance float, war reserve stocks, and four division sets in POMCUS (see also Appendix D).

b. The MLRS will represent only 7 percent of the total artillery assets by 1987.

---

8. The Army will also modernize many other systems including nuclear (the Pershing II missile) and air defense systems (the Patriot missile system). The program is also to acquire various smaller weapons and support equipment.

TABLE 3. WEAPONS SYSTEMS PROCUREMENT PROFILES: 1979-1987

System	1979	1980	1981	1982	1983	1984	1985	1986	1987	Total
M1 Tank	90	309	569	665	776	1,080	1,080	1,080	1,080	6,729
FVS	--	100	400	600	600	555	775	1,009	958	4,997
MLRS	--	12	32	68	72	76	44	29	--	333
AH-64	--	--	--	11	48	96	125	140	26	446
Hellfire Missile	--	--	--	680	3,971	6,218	5,683	6,853	6,351	29,756
DIVAD Gun	--	--	--	50	96	130	132	144	66	618
AHIP	--	--	--	--	--	16	44	56	92	208

SOURCE: Compiled by the Congressional Budget Office from various sources, including data in Department of the Army, "Congressional Data Sheets In Support of the FY 1983 President's Budget" (February 1982).

The two new division sets the Administration has designated to augment the POMCUS program would receive some modernizations, since the U.S.-based units would draw upon the POMCUS equipment to fight a war.

The M1 Tank

A subject of heated controversy in 1980 and 1981, the M1 tank was finally approved for full-scale production in November 1981. The M1's reliability in early tests has been criticized in some circles. As late as December of the same year, the General Accounting Office, for example, recommended that the Congress delay large-scale production of the tank until the M1's power train (that is, the turbine engine, transmission, and final drive) could be made more durable. 9/ Nonetheless, the Congress has supported continuing production and the Army plans substantial buys of the new tank--6,729 in total by the end of 1987.

9. For a detailed review, see General Accounting Office, "Large-Scale Production of the M1 Tank Should be Delayed until its Power Train is Made More Durable," MASAD 82-7 (December 15, 1981), and "Budgetary Pressures Created by the Army's Plan to Procure New Major Weapon Systems are Just Beginning," MASAD 82-5 (October 20, 1981). See also Congressional Budget Office, Reducing the Federal Deficit: Strategies and Options--A Report to the Senate and House Committees on the Budget, Part III (February 1982), pp. 43-46.

11-592 O - 82 - 6

Army managers see the M1 as offering significant advantages over the current M-60 tank and as a good match for the highly sophisticated Soviet T-80 now being developed. Improvements to the main gun and fire control system would allow a four-man crew to fire with high accuracy while the tank is either stationary or moving, at greater ranges, and at night. Current plans assume incorporation of the West German 120-millimeter gun in the mid-1980s; this should enable the tank to penetrate any armor known thus far. Greater cross-country speeds will make the tank more agile and less vulnerable. Arrayed armor (called "Chobham type") and a lower silhouette will also decrease vulnerability, particularly to high-explosive shaped-charge munitions. 10/

The M1's added capability will not, however, be cheap: the M1 tanks purchased in 1983 and beyond will cost $2.8 million apiece. The total program is estimated to cost $19.5 billion. When all 6,729 M1s are delivered, about 96 percent of the Army's force (that is, the active units, associated reserve units, training base, maintenance float, POMCUS stocks, and war reserves) will have been equipped with the M1 tank.

The Fighting Vehicle System

The FVS, an armored personnel carrier designed to operate with the M1 tank, offers major advantages over the current M113, which has little striking power. With a 25-millimeter cannon and Tube-launched, Optically-tracked, Wire-guided (TOW) antitank missiles (see glossary), the FVS will allow infantry troops to fight from within the vehicle and provide greater fire support for dismounted operations in either daylight or at night. The fielding of nearly 5,000 of these vehicles will increase by 180 percent the number of TOW antitank missile launchers in the Army's armored and mechanized infantry divisions. 11/ Furthermore, the vehicle's better cross-country speed and armor protection provide greater mobility and ability to survive attack ("survivability").

Total program acquisition unit costs for the FVS are currently estimated at $1.9 million; the full purchase could total $13.4 billion. Roughly 63 percent of the force will be modernized with the FVS when all of the vehicles procured through 1987 are delivered.

---

10. As compared to a munition that pierces through armor, a shaped-charge munition penetrates an object by concentrating its energy in a specific direction and burning through the shell with a gaseous mass.

11. See Department of the Army, The Posture of the Army and the Department of the Army Budget Estimates for Fiscal Year 1983, p. 21.

Multiple Launch Rocket System

Fielding the MLRS will give the United States a new counterfire capability that the Soviets already possess. (Counterfire, or counter-battery, is the ability to fire upon the enemy's artillery.) This system will not replace any current artillery pieces; instead, it will complement cannon artillery. Its greatest advantage is the ability to fire massive quantities of munitions very quickly. Compared with the standard eight-inch self-propelled artillery, the MLRS can increase firepower by a factor of 12. It can launch 12 unguided rockets in less than 60 seconds to ranges greater than 30 kilometers.

At $12.1 million per unit, the total procurement of 333 MLRS units is estimated at $4.1 billion. When all of these systems are delivered, 100 percent of the requirement for MLRS in the active force will be satisfied. 12/

Apache Attack Helicopter (AH-64) and Hellfire Missile

Equipped with the 16 Hellfire missiles, the AH-64 will provide significant improvements over the current fleet of Cobra helicopters armed with eight TOW missiles. The attack helicopter is charged with disrupting and destroying enemy armor, and the Cobra helicopter must expose itself long enough--usually 30 seconds--to guide the missile to its target. In addition to the all-weather capability of the AH-64, the principal advantage of this system is its increased survivability: the aircraft need not be exposed in order to launch its anti-tank missiles. Once a target is identified (either by ground observer or by other helicopters), the Hellfire missile "homes in" on the designated target. Plans include the future development of a "fire and forget" version of the Hellfire missile; once fired, the missile will not need any external target designation.

This added capability will be costly, however. The program acquisition unit cost for the helicopter alone is estimated at $16 million, for a total outlay of $7.4 billion for the full 446 units to be bought. When all are delivered, roughly 37 percent of the Army's attack helicopter fleet will be modernized.

---

12. Other U.S. modernization programs for artillery are in the area of improved conventional munitions (ICM). Increasing the effectiveness of current artillery assets, these munitions will provide a greater anti-tank capability.

Army Helicopter Improvement Program

The AHIP is designed to provide a more capable scout helicopter by the mid-1980s by modifying the existing OH58 helicopter. 13/ As an unarmed helicopter, its primary mission is to locate targets and to serve as an aerial designator for attack helicopters and artillery. Relative to the current scout helicopter, the AHIP, by means of a mast-mounted sight and a four-blade rotor, improves the ability to find targets at night and in heavy weather. 14/ No improvements for the airframe are planned, however.

Though the modification program would improve the OH58 helicopter, it is considered only an interim solution for the scout mission. The Army is now developing a new fleet of helicopters to perform the scout/observation mission that would complement the new AH-64 and Blackhawk transport helicopters. 15/ Thus, under AHIP, the Army could

---

13. To meet the requirements for the scout helicopter, the Army originally proposed the procurement of a new helicopter in the mid-1970s. In November 1979, the Army System Acquisition Review Council (ASARC) concluded that the Advanced Scout Helicopter (ASH) was not affordable and directed a modification program. See Hearings on Military Posture, Department of Defense Authorization for Appropriations for Fiscal Year 1983 before the House of Representatives Committee on Armed Services, 97th Congress, Second Session, Part III, pp. 285-287.

14. Improvement in the location of targets at night is a result of the incorporation of the mast-mounted sight, which contains a forward-looking infrared sensor and a laser rangefinder. Improvement in the helicopter's capability in Southwest Asia is achieved through the substitution of a four-blade main rotor for the existing two-blade main rotor, and improvements in the engine and transmission.

15. The Army's fiscal year 1983 budget request for Research and Development contained about $1 million for the development of a new light helicopter to perform scout/observation missions. In its first year of development, the Light Helicopter Advanced Technology Demonstrator (LHATD) program is designed to provide a helicopter that is lighter, uses less fuel, and reduces crew workload as compared with current fleets. See Department of Army, Fiscal Year 1983 Research, Development, Test, and Evaluation Congressional Descriptive Summary, pp. I425-428.

spend large sums to improve existing scout helicopters and by the early 1990s, could have a new model ready for procurement. Moreover, some of the target acquisition and designation mission could be met by the attendant capabilities of the new AH-64 and by use of the new Ground Laser Locator Designator (GLLD) designed for artillery. Both of these new systems are now in production, and each contains highly sophisticated target location capabilities.

Nonetheless, from 1984 to 1987, the Army plans to modify 208 of its fleet of OH58 helicopters. The unit cost is estimated at $4.4 million, for a total of $2.5 billion for the full complement of 578. Roughly 36 percent of the Army's scout helicopter force would be modernized by 1987.

The Division Air Defense Gun

The DIVAD gun is designed primarily to attack enemy helicopters and other low-altitude aircraft within an effective range of four kilometers. The DIVAD gun will replace the existing Vulcan 20-millimeter gun system, which has an effective range of two kilometers. It can also attack lightly armored vehicles and trucks. Mounted on a M48A5 tank chassis, this twin 40-millimeter gun system relies on a sophisticated F16 aircraft radar. The system has a rapid fire capability; after it identifies a target, the DIVAD gun can position and fire within ten seconds.

Though the DIVAD offers significant improvements over the current Vulcan air defense system, the latest version of the Soviet attack helicopter--the Hind E--may in fact have twice the effective range. Thus, were the Soviets to field the Hind E helicopters at rates consistent with recent experience, by the end of the 1980s, some 50 percent of the Pact helicopter fleet would have the capacity to fire its ordnance far beyond the range of the DIVAD gun. Further, the DIVAD's active radar (similar to that of the F16 aircraft), which gives the gun the ability to locate enemy targets at ranges of four kilometers, may also provide the enemy with a target on which to home in. This could increase the long-range vulnerability of the DIVAD system.

Despite these potential drawbacks, the Army plans to buy 618 DIVAD gun systems by 1987. The unit acquisition cost is estimated at $6.8 million, and the total program cost is roughly $4.2 billion. When all of these systems are fielded, the full requirement for the DIVAD gun will be satisfied.

CHAPTER III. THE EFFECTS OF MODERNIZATION ON FORCE RATIOS

The ultimate test of the balance of NATO and Warsaw Pact forces, of course, would be the outcome of a war. But the concept of deterrence, based on the premise that the balance of forces be such that war is a futile undertaking for either alliance, ought to obviate such a test. Indeed, the MBFR negotiations (see Chapter I), fruitless though they have been thus far, are motivated by a desire to maintain such a peacekeeping stalemate, but with a lesser investment of resources than either alliance is currently making. In light of the unproductiveness of the MBFR talks to date and the persistence of both sides in trying to improve the effectiveness of ground force materiel, however, an assessment of these efforts is warranted.

A judgment of the effectiveness of the proposed modernization efforts outlined in Chapter II must be drawn from purely hypothetical criteria. This chapter weighs the prospective force balance on the basis of an analytical tool called an Armored Division Equivalent (ADE), a device conceived and routinely used by the Defense Department. Details about how the ADE is constructed and what it measures are given below.

No theoretical gauge, no matter how carefully devised, however, can capture certain unquantifiable elements that could be decisively influential on the outcome of armed hostilities. Primary among these intangible factors are quality of leadership and tactics, personnel morale, and weather. The analysis that follows cannot take account of such factors. Reasonable estimates can only be made of the numerical and qualitative balance of military manpower and equipment on each side and the effects of modernization programs on this balance.

MEASURING THE FORCE BALANCE

The Armored Division Equivalent provides a measure of relative combat power over time. When this technique is used, each weapon is assigned a numerical value based on its technical capability and use in combat. The strength of a given combat unit is the sum of all the weapons available to it. That number is then divided by the equivalent score for a U.S. armored division in order to measure all units by a common denominator. As a method for assessing the current balance, CBO has updated an

earlier Department of Defense analysis based on ADEs. 1/ (Appendix B discusses this measure in more detail.)

To assess the balance of forces using ADE scores, this study makes numerous assumptions. The study concentrates on the balance of forces in Central Europe, since deterring, or if necessary winning, a conflict in Europe remains the U.S. Army's primary mission. The study also makes the assumption, standard in military planning, that NATO mobilizes four days after the Warsaw Pact, since NATO needs time to detect a Pact mobilization and make and implement a decision to mobilize.

The study also assumes that NATO would defend itself using 15 of the 16 active U.S. Army divisions, plus various reserve and other forces (the one division stationed in Korea is assumed unavailable). The allies would contribute some 32 active divisions plus various additional reinforcements. The Warsaw Pact is assumed to commit 120 divisions, each of which, however, would be numerically somewhat smaller than the typical NATO division. Since some 231 divisions are now available to the Pact, the study assumes that 111 Pact divisions would be allocated to the Chinese border, the northern and southern flanks of Europe, and to the strategic reserve. 2/ (The Defense Department often assumes that the Pact would confront NATO with only 90 divisions, despite the 231 divisions available; the effects of a 90-division threat are assessed below.)

Though useful, ADE scores have important limitations. They depend, of course, on the many difficult assumptions discussed above. Moreover, they require analysts to make uncertain judgments about the capabilities of each weapons system; those used in this study are discussed in Appendix B. The effects of tactical air power on the ground battle are not reflected in ADE scores, since both sides have substantial and perhaps offsetting tactical air capacity (see Appendix B). This may not, however, create any serious analytical distortion. Nor do ADE scores account for the effects of some major systems that the Army is buying, such as the AHIP scout helicopter and the Blackhawk transport helicopter. These limitations suggest that ADE scores should serve only as one guide to decisions that have to be made with other criteria in mind.

---

1. See U.S Department of Defense, A Report to Congress on U.S. Conventional Reinforcements for NATO (June 1976).

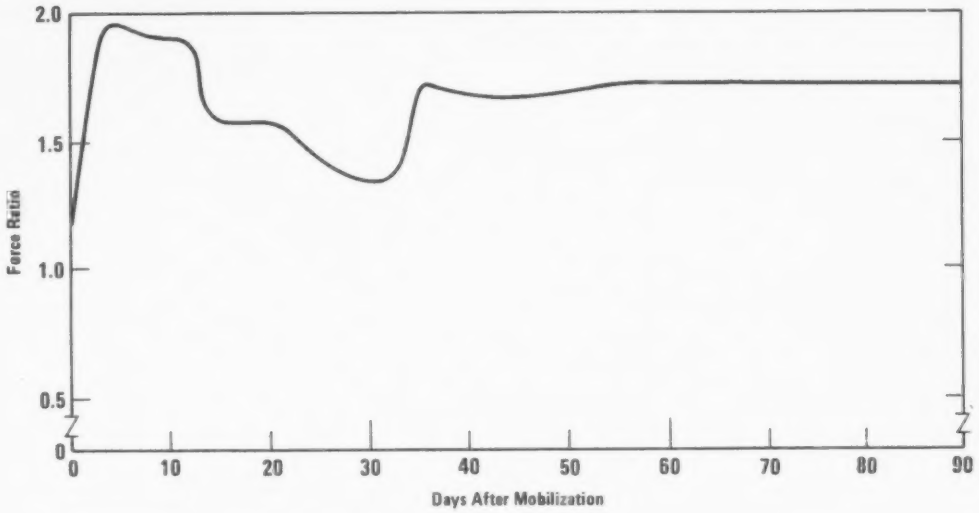
2. The 24 divisions of the Bulgarian, Hungarian, and Romanian armies are not included in this total because it is assumed that they would be committed to any conflict in the southern flank.

BEFORE MODERNIZATION--THE FORCE BALANCE AS OF 1980

NATO's defensive military posture is based on the assumption that NATO maintains enough forces at the ready--both equipment and troops--to deter an attack by the Warsaw Pact. This posture has both military advantages and disadvantages. While the Pact can choose the time and location of an attack, NATO's advantage is the choice of local terrain where it can fight from prepared positions. On the other hand, NATO's disadvantage is that it does not have all its forces in Europe and must bring a full one-third of their reinforcements from the United States. Within ten days after mobilization, for example, the United States could deliver four reinforcing Army divisions, since their equipment is prepositioned in Europe as part of the POMCUS program. As NATO brings its reinforcements forward, however, the Pact could be adding divisions to the front.

Figure 2.

Shifting Warsaw Pact/NATO Force Balance in 1980: 90 Days Following Pact Mobilization



SOURCE: Congressional Budget Office.

Figure 2 depicts graphically the shifting balance, as of 1980, of Warsaw Pact to NATO forces during the first 90 days following a Pact mobilization. The latest year for which a detailed Defense Department analysis is publicly available is 1976. The CBO has updated the analysis to

reflect the accelerated deployment of U.S. divisions achieved by recent programs for the 1980s. 3/ The figure measures the balance in terms of a ratio of the ADE scores for all Pact forces in the European theater to the scores for all NATO forces. According to this measure, the ratio of Pact to NATO forces exceeds 1.5:1 for most of the first 20 days after mobilization. Only between 20 and 30 days after mobilization does the ratio appear to dip below 1.5:1.

Pact-to-NATO ratios above 1.5:1 in the entire European theater may, however, be regarded as too favorable to Pact forces to give NATO a good chance of a successful defense. (A "successful defense" is a situation in which NATO forces are able to lose little territory and not withdraw behind initial defense lines.) To maintain the continuity of NATO's defensive line, U.S. strategists believe they require a force that has enough divisions to cover the front while simultaneously maintaining an attacker-to-defender ratio of 3:1 or less in any area where the aggressor chooses to attack. Meeting this requirement could call for an attacker-to-defender ratio of no more than 1.5:1 over the entire European theater. This 1.5:1 ratio is also what the Defense Department regards as minimally acceptable. The Department has stated that ". . . certain ratios. . . should not be allowed to favor an attacker by too great a margin. For example, if an attacker could achieve a favorable overall ratio of perhaps 1.5:1 in several of these respects, he could embark on such large local concentrations that the defender would find it difficult to prevent one or more breakthroughs." 4/

Thus the ratios suggest two periods when the Pact could have an advantage (see Figure 2). In the initial period following mobilization, the Pact advantage would result from NATO forces' needing time to move to and prepare their defensive positions. As reinforcements arrived from the United States, however, the early Pact advantage would begin to erode. But within approximately four weeks after mobilization, the Pact would recover its advantage as 30 more Pact divisions became available. The advantage would continue over the first three months after mobilization.

With this advantage, Pact forces could concentrate on a single NATO corps sector--resulting in a Pact/NATO force ratio of 6:1 in the main attack sector and as much as a 1:1 local force ratio in all other sectors. To respond to such an attack and lower the ratio at the primary sector to 3:1,

---

3. See Congressional Budget Office, U.S. Ground Forces: Design and Cost Alternatives for NATO and Non-NATO Contingencies (December 1980).

4. See U.S. Department of Defense, Annual Report, Fiscal Year 1976 and 197T, p. III-15.

NATO would have to move reinforcements from other corps sectors. Many NATO reinforcements would probably have to travel long distances to reach the main attack sector, so the likelihood of a Pact breakthrough might be high.

Force ratios deemed too favorable to Pact forces by U.S. Army tacticians could occur in part because of the Pact's numerical advantage in weapons. Of special concern is the Pact's advantage in numbers of tanks (2.64:1), armored personnel carriers (1.2:1), and artillery (2.07:1). In addition, the superior quality of equipment has been a subject of growing concern. This imbalance and the resulting force ratios have given impetus to the U.S. drive for modernization programs.

THE FORCE BALANCE AFTER MODERNIZATION

The programs of the United States and its NATO allies would improve by approximately 23 percent the capabilities of the NATO forces over the 1980 scores underlying the ratios shown in Figure 2. This assumes that U.S. forces improved by 35 percent and West German forces by 25 percent. (Capabilities of the other NATO allies are assumed unchanged because of the limited scope and uncertain progress of their modernization efforts.) If the Pact nations continue to modernize at current rates, they will increase their firepower by about 26 percent. Thus, the modernization now planned for NATO will merely maintain the present force balance; force ratios 30 days or more after mobilization would remain around 1.7:1. In other words, the United States is planning to spend at least $46 billion over the next five years just to hold onto the status quo. Without modernization, though, the NATO position could markedly worsen--ratios would hover around 1.9:1 (see Figure 3).

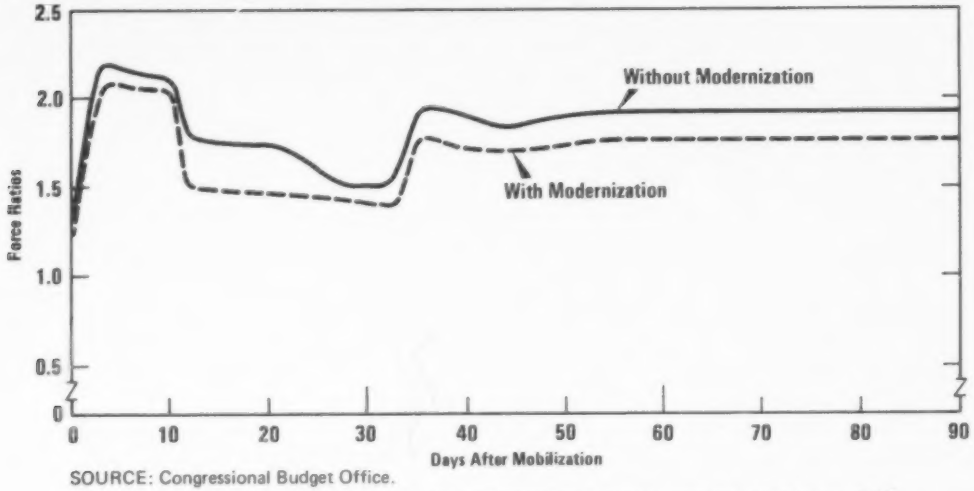
Effects of Different Assumptions on the Force Balance

The potential value of the U.S. modernization plan (measured by force ratios) can vary significantly, depending on what demands U.S. ground forces are called upon to meet. The following section illustrates this sensitivity to different assumed military scenarios.

Potential Significance of the Rapid Deployment Force. Increasing attention has been focused on possible military operations outside of NATO Europe during the past two years. In 1980, the headquarters for the Rapid Deployment Joint Task Force was established at MacDill Air Force Base in Tampa, Florida, with the mission of responding to contingencies outside of NATO Europe. If some U.S. forces are not available for a NATO defense,

Figure 3.

Effects of Modernization on Force Ratios in Europe's Central Region 90 Days After Mobilization: 1987



SOURCE: Congressional Budget Office.

NOTES: Assumes continuation of Warsaw Pact modernization at current rates and completion of U.S. Administration and West German modernization programs. Includes U.S. augmentation of POMCUS to six division sets.

the European balance of forces could be adversely affected. Such a situation could arise from the commitment of U.S. forces to the new Rapid Deployment Force.

As it is currently configured, the RDF could consist of up to 200,000 troops, to include as many as 100,000 reservists. No new combat forces have been created for the RDF, however. Existing units from all four services have been earmarked as available to the RDF. Army units currently available include the 82nd Airborne, the 101st Air Assault Division, the 24th Mechanized Infantry Division, and the 6th Combat Brigade (air cavalry). The assumption, then, is that any contingency involving the RDF would draw upon combat forces committed to NATO.

If each of these particular units were dispatched with the RDF simultaneous with an outbreak of conflict in Europe, U.S. ground force capability in NATO would be diminished. If three divisions were detained on an RDF mission, the Pact/NATO force ratio within some four weeks of mobilization would be 1.8:1 rather than 1.7:1. Similarly, if five U.S. Army divisions were committed to the RDF, the force ratio would be approxi-

mately 1.9:1 within four weeks of mobilization. Of course, such a reduction of force capability would occur only if the RDF units were committed and a simultaneous NATO conflict occurred.

Additionally, if the RDF Task Force were to be committed, it would require combat service support units--such as truck and medical units--from both the active and reserve forces. Almost 70 percent of these support units would come from the active force, since they could respond most quickly. All of these support units, however, would be needed for a NATO contingency.

A Limited Warsaw Pact Threat of 90 Divisions. Not all alternative assumptions favor the Warsaw Pact. Indeed, one reasonable asumption--a limit on the Warsaw Pact threat because of a lack of cohesion within the alliance--could improve NATO's prospects substantially. The previous analysis of the force balance in Europe is based on the assumption that the Soviet Union and its Eastern European allies would commit 120 divisions to the Central Region and operate militarily as a unified body. This assumption is deemed essential in defense planning in order to visualize the worst possible scenario for NATO. In reality, however, there are political indications that the Pact nations might not all function in concert in a military effort.

If, for example, the Eastern European armies were assumed to be unreliable or used as garrisons for rear areas to protect Soviet logistics lines, then the analysis of force ratios in the event of a Soviet attack would change. 5/ In such a case, only 90 divisions would presumably be available to attack NATO forces, since about 30 of the total 120 Pact divisions assumed in the base case are Eastern European forces. (The Defense Department also assumes a threat of 90 divisions, though not necessarily for the same reasons.) In the initial ten days after a Warsaw Pact mobilization, the assumption of a 90-division threat would lead to a force ratio of approximately 1.2:1, and the ratio would stabilize at that level within four weeks. This is a scenario that the Army would find far more favorable.

Other Assumptions that Might Improve the Balance. Whereas the basic analysis assumes that the Pact nations plan to allocate all new weapons to confronting NATO, in fact, the Pact might allocate some of the newer weapons to forces defending against other threats. If, for example, the Soviets were to allocate their new weapons in proportion among all existing divisions, rather than just modernizing those divisions focused on NATO, then the force ratios over the next five years might be tipped in favor of NATO.

---

5. See Congressional Budget Office, U.S. Ground Forces.

Moreover, the Warsaw Pact may modernize more slowly than it has recently--perhaps because of economic pressures or intra-alliance frictions such as those occurring in Poland. NATO's efforts might then be able to improve the present force imbalance. Recent years have not, however, brought any major slowdown in the Warsaw Pact's production of ground force materiel.

Finally, the force balance in Europe could also be altered in favor of NATO if all of the NATO allies were able to modernize as aggressively as the United States intends to do. If, for example, all of the NATO nations improved their force capabilities by approximately 35 percent over the next five years--as the U.S. plans to do--and the Warsaw Pact continued its modernization at current rates, then the theater-wide force ratio could reach roughly 1.6:1 by four weeks or longer after mobilization. Current economic conditions in Western Europe and the United States, however, suggest that this course would be unlikely.

CHAPTER IV. OPTIONS

In view of the anticipated size of the federal deficit--the CBO is currently projecting a deficit of some $155 billion for 1983--the Congress is considering numerous cost-cutting measures. The ground force modernization program is of course one area in which economies are under examination. This chapter therefore presents two alternatives to the current program that would bring down the costs of the Army's ground combat modernization from the total five-year sum of at least $46 billion now projected for all nine major systems proposed. As a basis for comparison, the chapter first reviews the costs (detailed in Chapter II) of the current program.

ALTERNATIVE APPROACHES FOR ARMY MODERNIZATION

The three courses available to the Congress examined in the first portion of the chapter are:

- Option I--Continuation of current policy as embodied in the Administration's modernization program;
- Option II--Reduction in the rate of acquisition; and
- Option III--Modification of the composition of the program.

The military effects to be achieved by Option I are examined in detail in the preceding chapter and recapitulated here in brief. For the hypothetical Options II and III, this chapter gives comparable analysis. Table 4 summarizes the projected procurement rates of the ground combat weapons systems examined in this study according to each of these alternatives.

As Chapter II states, however, even an effort as sizable and expensive as the Administration's program would accomplish little more in terms of the NATO/Warsaw Pact force balance than maintaining the status quo. Pact modernization is expected at least to stay abreast of NATO efforts. But with the likelihood of continuing Pact gains, maintaining the status quo may be a critically important policy objective. Thus, even in the current climate of fiscal austerity, it may be useful to know what actions and costs would be entailed in actually encroaching on the Warsaw Pact's advantage. Accordingly, this chapter concludes with a discussion of approaches that would permit the NATO allies to achieve an advantageous force balance in Europe.

TABLE 4. EQUIPMENT PROCUREMENT RATES UNDER ADMINISTRATION PLAN, REDUCED PACE OPTION, AND MODIFIED PROGRAM COMPOSITION OPTION, BY WEAPONS SYSTEM: 1983-1987 (In numbers of units)

Weapons System by Option	1983	1984	1985	1986	1987	Total
M1 Tank						
Administration	776	1,080	1,080	1,080	1,080	5,096
Slowed procurement	720	720	720	720	720	3,600
Altered composition	776	1,080	1,080	1,080	1,080	5,096
Fighting Vehicle System (FVS)						
Administration	600	555	775	1,009	958	3,897
Slowed procurement	600	600	600	600	600	3,000
Altered composition	600	555	775	1,009	958	3,897
Multiple Launch Rocket System (MLRS)						
Administration	72	76	44	29	b/	221
Slowed procurement	72	76	44	29	b/	221
Altered composition	72	76	44	29	b/	221
Apache Attack Helicopter (AH-64)						
Administration	48	96	125	140	26	435
Slowed procurement	48	96	96	96	96	432
Altered composition	48	96	125	140	26	435
Hellfire Missile a/	3,971	6,218	5,683	6,853	6,351	29,076
Division Air Defense (DIVAD) gun						
Administration	96	130	132	144	66	568
Slowed procurement	96	96	96	96	96	480
Altered composition	c/	c/	c/	c/	c/	c/
Army Helicopter Improvement Program (AHIP)						
Administration	--	16	44	56	92	208
Slowed procurement	--	16	44	56	92	208
Altered composition	c/	c/	c/	c/	c/	c/

SOURCE: Congressional Budget Office

a. Procurement of the Hellfire Missile is assumed constant in all options.

b. Procurement of the MLRS projected to be complete in 1986.

c. Altered composition option assumes deferment of DIVAD and AHIP.

Option I--The Administration's Present Plan for Army Modernization

The Administration's program to modernize Army equipment and preposition two more division sets of equipment under the POMCUS program would have important effects on capabilities, both in the early and later stages of a buildup. The POMCUS additions would improve the force balance in the first days after a mobilization began. Within ten days after NATO mobilization, the Pact/NATO force ratio in the Central Region of Europe would drop from the 1.65:1 now achievable to 1.48:1. This increased capability would satisfy the Army's minimally acceptable force ratio of 1.5:1.

The equipment modernization aspects of the program would, upon completion of procurement, affect capabilities throughout a buildup by the percentages presented in Chapter II and summarized in Table 5. Total U.S. firepower would increase by about 35 percent. The time when modernization yielded its most visible benefits would be later, after a mobilization, when all U.S. reinforcement units had arrived in Europe. Because even a complete inventory of the equipment to be modernized by 1987 would merely match, and not outweigh, Pact capabilities, however, force ratios 30 or more days after mobilization would remain around 1.7:1--markedly above the Army's stated acceptable 1.5:1 level. Of course, the ratios would be worse for NATO--1.9:1--were there no U.S. modernization (see Figure 3 in Chapter III).

The clearest problem with the Administration's program is its total five-year cost of about $37.6 billion (see Table 5). This amount (for seven major systems plus the costs for additional POMCUS materiel) is a substantial part of the total Army procurement bill, which will amount to at least $60 billion over the next five years. 1/ Even after adjustment for inflation, this represents an average annual increase of at least 6 percent over costs had the 1982 levels of procurement spending continued. In view of anticipated federal deficits, this rate of increase may not be affordable. And cutting the procurement associated with numerous other support systems (such as trucks and generators) may not be the way to reduce these costs, since these support vehicles often must replace aging systems. In many cases, the Army already has shortages in these areas. Other approaches to cost cutting that focus on the major weapons systems may be more productive areas for Congressional consideration.

---

1. Rather than withdraw materiel from current inventory, this analysis assumes that the Army would procure the equipment for two additional POMCUS division sets. The costs include procurement of all equipment other than tanks and fighting vehicles in a division set.

Option II--Slowing the Rate of Ground Combat Modernization

As current deficit-reducing efforts suggest, the Army may have to seek ways to achieve as much as possible of its modernization program at lower cost. One approach could be to continue to procure all of the weapons systems now proposed by the Administration but at slower rates. In addition, this option would forego the Administration's proposed prepositioning of two additional POMCUS division sets in Europe. It would, though, retain the emphasis on introducing more capable armor and anti-armor systems, but it would somewhat delay completion of the program. It would achieve some budgetary savings relative to the Administration's program, but at some cost in overall improvement in force capability (see Table 5). Variations of this approach (commonly called a "stretchout") have been adopted in previous years. 2/

As outlined here, this option would largely limit procurement to minimum production quantities, given current or planned facilities and planned use of those facilities. For example, this option would produce 720 M1 tanks a year, starting in 1983 instead of the 776 planned; this represents a minimum production rate--the output at the two existing tank plants, assuming they operate one eight-hour shift a day, five days a week. The procurement profiles for the FVS, AH-64, DIVAD gun, and AHIP would also represent minimum production quantities. 3/ Only the buy of the MLRS would not change, since it is already nearly complete.

---

2. Both the M1 tank and FVS programs were "stretched out" in the original fiscal year 1982 budget, submitted by President Carter, as compared with the planned program submitted with the 1981 budget. For example, in fiscal year 1982, the Administration proposed to buy 445 fewer tanks over the 1982-1985 period than were planned in the 1981 budget. Further, 151 fewer tanks were proposed for procurement in 1982 than were planned for in the 1981 budget. Similarly, over the period 1982-1985, almost 1,300 fewer FVSs were planned for procurement in the 1982 budget than were planned in the outyear program associated with the 1981 budget. See Department of the Army, "Congressional Data Sheets in Support of the FY 1981 President's Budget" (1980) and Department of the Army, "Congressional Data Sheets in Support of the FY 1982 President's Budget" (January 1981).

3. This option would produce 600 FVSs a year--the output at one plant operating two shifts for eight hours a day five days a week. The DIVAD gun would be produced at an annual rate of 96; this represents one shift's output of a plant five days a week. The AH-64 would be produced at a rate of 96 a year starting in 1984.

Relative to the Administration's program, this option would cut 1983 procurement costs by $330 million and by a total of $6.2 billion over the five years (see Table 5). Besides the savings from reducing procurement rates, about $1.6 billion would be saved over the next five years by adding no further POMCUS equipment.

Foregoing the prepositioning of two new divisions' worth of equipment in Europe would modestly decrease capabilities shortly after a mobilization. Without the new POMCUS equipment, force ratios would be about 1.65:1 ten days after mobilization, which is appreciably above the Army's minimum ratio of 1.5:1. (With the additional prepositioning, the ratio would be 1.48:1.) On the other hand, many critics of the Administration's plan have argued that prepositioning two more division sets of equipment, in addition to the four already in place, would expose too much U.S. equipment to potential destruction before U.S. reinforcements arrived. Further, the addition of more equipment in Europe could reduce the Army's flexibility to deploy units anywhere else.

This option would also slow modernization, although not by major amounts. When all the equipment purchased was delivered, the Army could modernize the following percentages of the active force (compare with page 20 for Administration's plan):

Force or fleet	Modernized System	Percentage of Force Modernized by 1987
Tanks	M1 tank	75
Armored personnel carriers	FVS	52
Artillery rocket systems	MLRS	100
Attack helicopters	AH-64	37
Air defense guns	DIVAD gun	86
Scout helicopters	AHIP	36

Looked at another way, this program would delay the completion of systems from one year (for DIVAD) to as many as three years (for the FVS).

Slower modernization would also mean that, when all the equipment was delivered, Army firepower would be greater by about 32 percent, rather than the 35 percent to be achieved by Option I. This would mean that, 30 days or more after mobilization, the Pact/NATO force ratio would rise to 1.77:1 compared to 1.7:1 under the Administration's plan.

As all these measures suggest, this option would leave NATO worse off in the event of a conflict, but only modestly so. Thus, this option is

consistent with a willingness to accept slight added risks in recognition of the need to accommodate tight fiscal constraints.

One drawback to this option is that, with stretchouts, unit costs would rise, because savings that normally come with production experience would be delayed, and because certain numbers of units would be produced later, when inflation has pushed up costs. For example, 1984 acquisition unit costs of the M1 tank under this option would be at least 6 percent higher than under the Administration's faster approach. The increase is small, because this option would not allow production to fall below minimum economical rates, given current or planned facilities. But even this quite moderate unit cost growth suggests why the Defense Department is committed to maintaining high rates of production.

Another possible problem is that the savings achieved under this option are close to the maximum that can be achieved without further increases in unit costs. For example, if M1 tank procurement were cut to 600 (versus the minimum economical rate of 720 in this option), then acquisition unit costs in 1984 would be at least 8 percent higher than under the Administration's plan to buy 1,080 tanks. Thus, if the Congress must save larger amounts, or if it wants to keep the unit costs from rising above current levels, it might wish to consider altering the actual composition of the modernization program.

Option III--Modifying the Composition of Ground Combat Modernization

To achieve budgetary savings, this alternative would sustain procurement of most major armor and anti-armor systems at higher rates of production while indefinitely deferring a few. Specifically, this option would delay procurement of the DIVAD gun and the AHIP. [4] Like Option II, it would also forego the prepositioning of the two additional divisions sets of equipment in Europe.

---

4. Postponement of these systems might be appropriate in light of criticisms that have been raised regarding the cost and performance of the AHIP and the DIVAD gun. Criticism of the AHIP has centered around costs and the system's optimization to a particular geographic location. Criticism of DIVAD has ranged from concern regarding the gun's vulnerability to radar-homing missiles, to its obsolescence relative to improved Warsaw Pact capabilities. For amplification, see Deborah G. Meyer and Benjamin F. Schemmer, "... You ought to look at what's happening on the other side of the two-way street," Armed Forces Journal (September 1982), p. 82; and Gregg Easterbrook, "DIVAD," Atlantic Monthly (October 1982), pp. 29-39.

TABLE 5. COSTS AND COMPLETION DATES OF GROUND COMBAT MODERNIZATION UNDER ADMINISTRATION PLAN, REDUCED PACE OPTION, AND MODIFIED COMPOSITION OPTION

Total Costs 1983-1987 (in billions of dollars) [a]	Pace of Modernization [b] System	Percent Modernized Through 1987	Year When Modernization Complete	Percent Improvement in Overall Force Capability
	Option I. Administration Program			
37.6	M1 Tank	96	1988	35
	FVS	63	1990	
	MLRS	100	1986	
	AH-64	37	1995	
	DIVAD gun	100	1987	
	AHIP	36	1991	
	Option II. Slowed Pace of Procurement			
31.4	M1 Tank	75	1990	32
	FVS	52	1993	
	MLRS	100	1986	
	AH-64	37	1995	
	DIVAD gun	86	1988	
	AHIP	36	1991	
	Option III. Modified Program Composition			
31.2	M1 Tank	96	1988	[c]
	FVS	63	1990	
	MLRS	100	1986	
	AH-64	37	1995	
	DIVAD gun	0	1992 and beyond	
	AHIP	0	1992 and beyond	

SOURCE: Congressional Budget Office.

a. In inflated dollars.

b. Requirements for weapons to fill force structure are based on CBO estimates (see Appendix D).

c. DIVAD and AHIP excluded in force effectiveness analysis.

Over the 1983-1987 period, the investment costs of this modernization option will total roughly $31.2 billion, or some $6.4 billion less than the Administration's proposal. Again, about $1.6 billion of these savings would derive from not adding to the POMCUS program.

As under Option II, foregoing the POMCUS additions would reduce NATO capabilities early in a buildup. This approach would, however, minimize the amount of U.S. equipment that was vulnerable before reinforcements arrive and would not reduce the Army's capabilities to deploy troops elsewhere. Unfortunately, though, assessing the effects of this approach on NATO capabilities over time is more difficult. It would sustain the procurement rates for all the ground attack systems--which this study is intended to analyze--and neither of the two systems that would be deferred are ground attack systems. The analysis cannot serve to illustrate the effects of postponing these two systems, however. The potential loss in operational capability that could result if these systems were not available can be assesed in descriptive terms only; it cannot be quantified numerically or expressed in terms of the effects on force ratios.

To counter enemy helicopters without the DIVAD gun, the Army would have to rely primarily on the existing Vulcan air defense gun. The Vulcan gun lacks the sophistication of the DIVAD gun; for example, the Vulcan has only a 20-millimeter gun system with an effective range of two kilometers, and it lacks the DIVAD's all-weather capability. Thus, some compensating changes would have to be made. The Vulcan gun could be supplemented by augmented numbers of the Stinger air defense missile, which is now deployed. (The Stinger--of which some 1,600 are now deployed--is a shoulder-fired missile that homes in on a heat source; its primary mission is to attack low-altitude aircraft and helicopters.) More use of the Stinger along with the Vulcan would give a broader array of capabilities even if the Army had no DIVAD guns. Both the Vulcan and DIVAD guns have the drawback of being vulnerable to enemy helicopters.

As far as AHIP is concerned, this modification of the current-generation OH58 helicopter is considered only to be of temporary use. As Chapter II states, even as AHIP takes shape, the Army is developing a new fleet of helicopters that are likely to supersede the achievements of AHIP. This suggests that AHIP might consume $2.5 billion in an effort to yield a product that, while highly sophisticated and functional, is only an interim solution for the scout helicopter mission.

As this discussion suggests, then, some capabilities would be lost if DIVAD and AHIP were not procured. To whatever degree these capabilities seem critical, however, there may be other Army systems the

procurement of which could be delayed. Some analysts have suggested, for example, that alternatives to the FVS might provide substantial capability at lower cost; concerns have also been raised about the M1 tank that could argue for delaying the tank (see Chapter II). The exact systems chosen for delay would ultimately require difficult judgments by the Administration and the Army.

THE COSTS OF MOVING THE FORCE BALANCE BEYOND THE STATUS QUO

Even the most costly of the courses examined above--the Administration's modernization plan--would still yield force ratios that fall short of what the Defense Department and the Army would regard as optimal. Instead of the 1.7:1 ratio achievable 30 days after mobilization, the following section outlines what would be entailed coming closer to the Army's minimum acceptable force ratio of 1.5:1 if money were readily available to make such efforts.

Improvements from More Rapid Modernization

As a first step, the United States could accelerate its force modernization. Consistent with this more aggressive policy, prepositioning of two additional POMCUS division sets in Europe would also proceed.

In particular, the Congress could decide to increase the annual procurement levels of the M1 tank, the FVS, and the AH-64 to the maximum level possible with current or planned facilities. Such accelerated modernization would allow the Army to arm a larger proportion of the active force with new equipment by the end of 1987. By then, the Army would be able to modernize 111 percent of its operational tank fleet with M1 tanks (the excess over 100 percent would be used to fill additional war reserve stocks or additional POMCUS sets), 80 percent of the personnel carrier fleet with the FVS, and 47 percent of the attack helicopter fleet with the AH-64. Buys of the MLRS and the DIVAD gun could remain at the Administration's planned levels, since these rates of procurement would modernize the existing force fully within the coming five years. Procurements of the Hellfire missile and AHIP could also remain at the Administration's levels.

Table 6 shows the hypothetical procurement profiles under this approach. The analysis assumes that all of the weapons included in the Administration's proposal would be procured; the rates of procurement for the M1 tank, the FVS, and the AH-64 would be increased above those levels in the Administration's baseline program. The procurement profiles for

these three systems illustrate the maximum production rates for the programs. In the case of the FVS, for example, approximately $234 million has been included for the special tools and facilities in 1983 and 1984 to meet maximum production rates.

Over the 1983-1987 period, the investment costs of this approach would total approximately $44.7 billion. This represents a total five-year increase of $7 billion over the Administration program's $37.6 billion for the specific weapons systems considered in this study.

This accelerated plan would improve current U.S. force capability by more than 39 percent by the end of 1987. It would, however, by 30 days after mobilization, yield an all-NATO theater-wide force ratio of 1.68:1--still not as good as the Army's minimum benchmark of 1.5:1.

TABLE 6. PROCUREMENT PROFILES THAT WOULD ACCELERATE ARMY MODERNIZATION: 1983-1987 (In units)

Weapons System	1983	1984	1985	1986	1987	Total
M1 Tank	776	1,080	1,080	1,440	1,800	6,176
FVS	775	830	1,080	1,080	1,440	5,205
MLRS	72	76	44	29	b/	221
AH-64	48	96	125	140	140	549
Hellfire	3,971	6,218	5,683	6,853	6,351	29,076
DIVAD Gun	96	130	132	144	66	568
AHIP	a/	16	44	56	92	208

SOURCE: Congressional Budget Office.

a. Scout helicopter modification program not to begin until 1984.

b. Procurement of the MLRS completed in 1986.

Improvements from Force Structure Increases

To improve the force balance appreciably by the late 1980s and simultaneously achieve a stable theater-wide ratio of at least 1.5:1, increases in the number of forces of both the United States and all the other NATO allies would have to accompany modernization. For example, the United States would have to add the equivalent of two fully supported armored divisions with 100,000 new troops to the active force structure. 5/ Moreover, the desired ratio would be achieved only by a NATO-wide effort. The NATO allies would have to add the equivalent of four fully supported armored divisions and improve the firepower of their existing divisions by means of aggressive modernization.

Production at maximum rates feasible with current facilities would not, however, provide enough weaponry to equip fully two new divisions by the end of the 1987 while also modernizing other divisions at an accelerated rate. Thus, the two new divisions might not be fully equipped until late in the decade. The additional costs to modernize fully the two new divisions are estimated at $5.4 billion. (Approximately $4.5 billion would be needed in 1988 and 1989 to complete production of the FVS.)

The personnel of the two new divisions would be based in the continental United States. On the basis of Army data, this study assumes that base construction would entail one-time costs of about $4.7 billion. Inasmuch as these costs assume construction of new facilities for the troops, they probably represent upper bounds on costs. 6/

The costs of increasing Army personnel by 100,000, including added enlistment bonuses necessary to increase recruitment, would come to about $6.7 billion over the five-year period. 7/ This assumes that manpower

---

5. The estimate of 100,000 additional troops assumes that the Army would add two armored divisions and all of its associated nondivisional structure (such as the nondivisional combat increment and the tactical support increment).

6. See Congressional Budget Office, "Costs of Withdrawing Troops from Europe," Unpublished Staff Working Paper (June 1982).

7. These costs include not only pay and allowances but also recruitment costs. The following assumptions were made: the ratio of officers to enlisted personnel is assumed to remain constant at current levels; the added costs also assume that the proportion of recruits holding high school diplomas would remain at levels consistent with those projected for a smaller force over the five-year period.

would be increased by 20,000 a year. Further, there would be added operating and support costs associated with two modernized divisions. These annual costs would total at least $2 billion when the two divisions were complete.

The addition of 100,000 persons to the now all-volunteer Army could also encounter recruiting difficulties. While the U.S. economy is in its current condition, especially with unemployment at a post-World War II record high level of 10.4 percent (as of November 1982), recruitment is not a serious problem for the Army. But should a recovery materialize, other prospective employers, especially those in the private sector, could create tough competition for needed Army personnel. Indeed, without additional recruiting incentives, the Army would be unable to increase its active-duty manpower strengths while also meeting the minimum standards for recruit quality recently mandated by the Congress. 8/ Additional "targeted" pay (such as enlistment bonuses or educational benefits) aimed only at recruits with special skills that are now in short supply could probably allow the Army to meet its numerical goals for recruits and the minimums for recruit quality. These bonuses would add about $885 million over the five-year period, costs that are included in the total discussed above. In recent years, however, reluctance has been expressed in the Congress over increasing spending on enlistment bonuses. 9/ Without these increases, recruiting goals would have to be met by lowering manpower standards, enacting costly across-the-board pay increases, or returning to some form of conscription.

Thus, Army costs for procurement and operation would come to $17.9 billion over the next five years. Coupled with the costs of accelerated equipment modernization, this implies costs totaling $25 billion. Nor are these all the potential costs. The two added divisions would, of course, be

---

8. See Congressional Budget Office, "Alternative Military Pay Raises for Fiscal Years 1983-1987: Their Effects on Enlisted Recruiting, Retention, and Personnel Costs," Unpublished Staff Working Paper, (September 1982).

9. See Congressional Budget Office testimony before the U.S. Senate Committee on Veterans' Affairs, July 28, 1982.

intended for use in a NATO war. The divisions and their equipment would be transported to Europe by sea--which might well require added ships with their own budgetary implications. 10/

---

10. To deliver the two divisions to Europe within 14 days after mobilization, 16 additional fast sealift ships would be required. The estimated cost to procure these ships is as much as $6.2 billion (in 1983 dollars). On the other hand, if the two divisions were to be delivered after 30 days following mobilization, eight ships would have to be procured; the estimated cost for procurement would total about $3.1 billion (in 1983 dollars). This estimate is based on the procurement of fast sealift (roll-on/roll-off) ships.

CHAPTER V. LONG-RUN COSTS OF MODERNIZATION— A SELECTIVE ASSESSMENT

In considering projected costs of the Administration's proposed modernization program for the Army, a key issue of concern to the Congress is long-run costs. Important among these are the weapons systems' operating costs, which begin as new equipment is fielded and extend through the lifetime of each new system. This chapter charts the course of long-term operating costs of the M1 tank and the FVS mechanized infantry fleets. Examination of these two systems' operating costs over time gives an illustration of the order of magnitude of this cost component for the various systems the Administration proposes to procure.

Operating and support costs--which can account for as much as two-thirds of the total life-cycle costs of a weapon--will of course increase the Army's overall budget. Projected rises in the consumption of fuel and repair parts, as well as new maintenance concepts, all contribute to the higher operating costs of modernization. In some instances, increased firepower will also generate higher operating costs. For example, the turret and 25-millimeter cannon of the FVS will probably increase the requirements for mechanics and for cargo-carrying vehicles in a mechanized infantry battalion.

Providing adequate funds to operate and support the modernized systems is critical: effectiveness and combat readiness are a direct function of operating tempo. No single estimate is now available that projects the additional resources required to operate and support the force once it is fully modernized. In part, this is because the Army has only begun to field these new systems; the Army itself relies on test data and contractors' estimates. In the absence of any single overall cost estimate, the CBO has mostly used Army data to project the ongoing costs of operating and supporting the M1 tank and FVS battalions. 1/ These units

1. The operating and support cost elements included in this estimate are the consumption of repair parts at the maneuver battalion, direct support maintenance battalion, and depot; petroleum, oil, and lubricants (POL); Military Manpower, both pay and military occupational specialty training. The CBO has used data from the following sources to derive its cost estimate: Force Cost Information System, Comptroller of the Army; and Department of the Army, Army Modernization Information Memorandum (August 1981).

account for approximately half of all active Army maneuver battalions and roughly one-fourth of the total active Army battalions.

Over the next five years, the Army plans to buy enough M1 tanks and FVSs to equip 50 tank battalions and 46 mechanized infantry battalions and to provide assets for training, systems in the maintenance pipeline, and some war reserve stocks. 2/ At present, the combined cost to operate and support these battalions, equipped with the current M113 armored personnel carriers and present-generation M60A1 tanks, is estimated at $2.4 billion.

Costs for M1 Tank

The high procurement cost of the M1 tank relative to its two predecessors--the M60A1 and the M60A3--presages a comparable disparity in operating costs. The unit cost (in constant 1983 dollars) of the M1 is estimated at $1.9 million--nearly 50 percent more than the $1.2 million for the M60A3. A more sophisticated electronics system (including an on-board computer) and a system to stabilize the gun account for much of the difference. The M1 is much faster than either antecedent, but it also uses about two times as much fuel per mile.

The CBO estimates that, with the fielding of the M1 tank, the cost to operate and support a tank battalion will increase by as much as 41 percent over levels for battalions equipped with M60A1 tanks. (Costs would increase by 35 percent over levels for the existing but more modern battalions equipped with M60A3 tanks.) The higher cost will come from increased consumption of petroleum, oil, and lubricants, and importantly, from more expensive repair parts. The new "fix forward" concept of maintenance may also be more costly, since it relies on more test and diagnostic equipment at the "maintenance levels" closer to the battle area to facilitate the repair or replacement of damaged parts.

A comparison of the operating and support costs estimates for a tank battalion equipped with M60A1s and M1s is presented in Table 7. 3/ A range of estimates for the M1 is presented. The Office of the Comptroller of the Army estimates that the tank's operating and support costs will

---

2. In some cases, the Army withdraws equipment to fill its POMCUS stocks; equipment could be withdrawn either from war reserve stocks or active units. (War reserve stocks are those items of equipment required to sustain combat until factories can produce replacements.) In other cases, the Army could buy additional equipment to fill its POMCUS stocks.

3. The M60A1 tank battalion is chosen as a basis for comparison because the M60A1 is currently the mainstay in the active force.

TABLE 7. ANNUAL RECURRING OPERATING AND SUPPORT COSTS FOR TANK BATTALIONS (In millions of 1983 dollars)

Operating and Support Items	Army a/ M60A1	Army a/ M60A3	Army a/ M1	M1 High
Repair Parts (P_2 Mission)	1.81	2.14	2.75	5.07 b/
Repair Parts (P_2 Base Operations)	0.14	0.14	0.14	0.14
Repair Parts (P_7 Maintenance)	1.09	1.10	1.57	3.05 c/
Subtotal	(3.04)	(3.38)	(4.46)	(8.26)
Other	6.14	6.15	6.65	6.65 d/
Secondary Items (Procurement Funded)	3.05	3.59	4.6	5.58 e/
Military Personnel	8.90	8.90	9.00	9.00
Total	21.13	22.02	24.71	29.50
Percent Change (from M60A1)	--	4	17	41
Percent Change (from M60A3)	--	--	12	35

SOURCES: Compiled by the Congressional Budget Office from sources cited below.

NOTE: P_2 Mission, P_2 Base Operations, and P_7 Maintenance refer to the different subprograms of the Operations and Maintenance appropriation.

a. The source of the Army cost estimates is the Force Cost Information System (FCIS), Office of the Comptroller of the Army. Estimates were provided in April 1982.

b. From Department of the Army, Army Modernization Information Memorandum (August 1981).

c. Scaled using ratio at P_2M level between M1 high and M60A1.

d. FCIS Data; includes military occupational specialty training, supply, medical, and overhead.

e. Scaled using unit procurement costs of $1,066,846 for M60A3 and $1,658,167 for M1 (constant 1981 dollars).

increase by approximately 17 percent over those of the M60A1. This estimate generally assumes that the maintenance workload required for the M1 will be roughly comparable to that required for the M60A1 tank, even though the M1 is more complex. The CBO's higher estimate of 41 percent, however, assumes a greater maintenance workload based on Army planning data now used in budgeting for the first M1 tank battalion, and provides an estimate of costs for secondary items (such as transmissions) that is adjusted in proportion to the procurement costs of the M1 and M60A3. For lack of any estimates for additional costs for maintenance personnel at central repair facilities ("depot" level), CBO assumes that these costs would be comparable to those required for the M60A1 tank. Depot maintenance may experience cost increases, however, since the new equipment will probably require mechanics with additional skills. (Notes to Table 7 detail data sources.)

Costs of the Fighting Vehicle System

The pronounced differences in capability between the new FVS and its predecessor, the M113 armored personnel carrier, will be reflected not only in unit procurement costs ($1.2 million versus $160,000) but also in operating costs. Whereas the M113 is essentially a tracked vehicle with no weapons and only light armor, the FVS has a turret, 25-millimeter cannon, and TOW missile launcher.

The CBO estimates that once the FVS is fielded, the costs to operate and support a mechanized infantry battalion could increase by 59 percent over levels for M113-equipped battalions. As with the M1 tank, cost increases derive from increased consumption in petroleum, oil, and lubricants, and from more expensive repair parts.

A comparison of the operating and support cost estimates for a mechanized infantry battalion equipped with M113s and with FVS is given in Table 8. A range of estimates is also provided for the FVS. The most recent estimates from the Office of the Comptroller of the Army suggest that the operating and support costs of the mechanized infantry battalion will increase by approximately 23 percent. (Earlier Army estimates put the increase as low as 3 percent.) This 23 percent estimate assumes that the FVS will require a maintenance workload generally comparable to the M113, even though the FVS is much more sophisticated. Alternatively, the CBO's higher estimate of 59 percent assumes a greater maintenance workload--particularly because of the incorporation of the turret--and adjusts the costs of the secondary items in proportion to the costs of the FVS and M113. As in the case of the tank battalion, the costs of depot maintenance personnel are assumed to be equal to those required for the M113, since current data are not available.

TABLE 8. ANNUAL RECURRING OPERATING AND SUPPORT COSTS FOR MECHANIZED INFANTRY BATTALIONS (In millions of 1983 dollars)

Operating and Support Items	Army a/ M113	Army a/ FVS	FVS High
Repair Parts (P_2 Mission)	0.77	1.93	3.50 b/
Repair Parts (P_2 Base Operations)	0.21	0.21	0.21
Repair Parts (P_7 Maintenance)	0.36	1.24	1.64 c/
Subtotal	(1.34)	(3.38)	(5.35)
Other	6.93	7.75	7.75 d/
Secondary Items (Procurement Funded)	1.26	3.41	9.40 e/
Military Personnel	12.73	12.86	12.86
Total	22.26	27.40	35.36
Percent Change	--	23	59

SOURCES: Compiled by the Congressional Budget Office from sources cited below.

NOTE: P_2 Mission, P_2 Base Operations, and P_7 Maintenance refer to the different subprograms of the Operations and Maintenance appropriation.

a. The source of the Army cost estimates is the Force Cost Information System (FCIS), Office of the Comptroller of the Army. Estimates were provided in April 1982.

b. From Department of the Army, Army Modernization Information Memorandum (August 1981).

c. Scaled using ratio at P_2M level between FVS and M113.

d. FCIS Data; includes military occupational specialty training, supply, medical, and overhead.

e. Scaled using unit procurement costs of $136,768 for M113 and $1,017,972 for FVS (constant 1981 dollars).

Total Costs of the M1 and the FVS

The CBO estimates that, with the fielding of the M1 tank and the FVS by 1987, the additional annual recurring costs (in 1983 dollars) to operate and support these modernized battalions will be approximately $1.1 billion (see Table 9). If all the active tank and mechanized infantry battalions are modernized, the additional annual recurring costs are estimated at approximately $1.5 billion.

These estimates include the costs (not discussed) of the "direct support" maintenance battalions, which perform much of the repair. (Each Army division is required to have one direct support maintenance battalion as part of its Division Support command to serve all of its battalions.) In

TABLE 9. COMPARISON OF ANNUAL RECURRING OPERATING AND SUPPORT COSTS FOR TANK AND MECHANIZED INFANTRY BATTALIONS (In millions of 1983 dollars)

Type of Battalion	Current per Battalion	Per Modernized Battalion	Total Modernized Battalions	Difference
Tank Battalion	21.1 for M60s	30.0 for M1s	1,500 for 50 Battalions	445
Mechanized Infantry Battalion	22.3 for M113s	35.4 for FVSs	1,628 for 46 Battalions	603
Maintenance Battalion, Armored Division	31.7	36.2	145 for 4 Battalions	18
Maintenance Battalion, Mechanized Infantry Division	30.4	44.1	265 for 6 Battalions	82
Total	--	--	3,538	1,148

SOURCE: Congressional Budget Office.

the absence of any cost estimate for the maintenance battalions in the armored and mechanized infantry divisions, the CBO adjusted costs for direct support to the change in each of the categories of operating and support costs at the maneuver battalion (either tank or mechanized infantry). The CBO estimates that the recurring costs of a maintenance battalion for an armored division will increase by 14 percent, from an annual $31.7 million to $36.2 million. The recurring costs for a maintenance battalion in a mechanized infantry division is estimated to increase by 45 percent, from $30.4 million a year to $44.1 million.

Costs of Other Systems

The extra $1.5 billion reflects major but not the total added costs of modernizing U.S. Army ground combat forces. Several weapons systems--such as the AH-64 and the MLRS--could also incur high operating costs. Unfortunately, data on these systems are not available to allow detailed estimates comparable to those presented above for the M1 tank and the FVS. Judging from the technological sophistication embodied in these several systems, it can be assumed that additional maintenance and support costs could also be substantial. Nonetheless, these operating costs might not require dramatic increases in the Army's total budget for operations and maintenance. The $1.5 billion in extra operating costs associated with equipping all the forces with the M1 tank and the FVS amounts to about 9 percent of the Army's 1983 budget request for operations and maintenance. If operating and support costs for the other ground combat systems comprised in the Administration's modernization plan are comparable, they may not be disproportionately large relative either to procurement costs or to their value in maintaining NATO's defensive posture.

APPENDIXES

APPENDIX A. COMPOSITION OF THE U.S. ARMY

The following units, ranked in ascending order of size, constitute the subdivisions of the U.S. Army today.

Maneuver Platoon

The smallest standard fighting formation commanded by a commissioned officer. A tank platoon has about 20 personnel and five tanks; a mechanized infantry platoon has about 40 personnel, divided into three squads of 11 troops each, plus a headquarters element. Each squad is mounted in an armored personnel carrier.

Maneuver Company

The next largest standard fighting formation commanded by a commissioned officer. It consists of three maneuver platoons and support elements. Its strength varies from about 90 personnel and 17 tanks in a tank company to about 150 personnel and nine infantry carriers in a mechanized infantry company.

Maneuver Battalion

A maneuver battalion consists of three maneuver companies; a company-sized element to provide mortar and antitank fire support to the maneuver companies; and another company-sized element for command and control, maintenance support, medical support, food service, and supply. A tank battalion has about 550 personnel and 54 tanks. A mechanized infantry battalion has about 800 personnel.

Brigade

A command and control unit capable of controlling up to five maneuver battalions. Three or four battalions are normally assigned to it. A "mechanized" brigade has more mechanized infantry battalions than it has tank battalions.

Division

The standard elements of a division include command and control units; artillery battalions (500-600 personnel each); aviation elements; and engineer battalion (approximately 900 personnel); several other battalion-sized units that can provide medical, maintenance, supply, and other types of support; and three brigade headquarters. Maneuver battalions are

assigned to a division on the basis of the division's probable missions; as few as six or as many as 15 maneuver battalions could be assigned to a division. The missions of a division also determine the mix of tank battalions and mechanized infantry battalions. Armored divisions stationed in Europe have six tank battalions and five mechanized infantry battalions. Mechanized infantry divisions in Europe have six mechanized infantry battalions and five tank battalions.

Corps

This is a command and control unit that is staffed and equipped to control from two to five divisions. Artillery battalions, communications units, supply, medical, maintenance, engineer, and other support organizations are assigned to the corps to provide the added support structure each division needs to fight.

APPENDIX B. METHOD FOR ASSESSING THE IMPROVEMENTS IN FORCE CAPABILITIES

The methodology used in this analysis provides a static estimate of potential combat power based upon the mix, quantity, and performance characteristics of the various weapons systems. The Defense Department commonly uses this technique to measure ground force capabilities. As a baseline for the 1980 U.S force capability, the CBO used the the 1976 Defense Department study 1/ and updated it to reflect recent force changes, such as the accelerated deployment of U.S. divisions to Europe.

U.S. WEAPONS CAPABILITY

Each of the weapons systems to be modernized--tanks, armored personnel carriers, field artillery, attack helicopters, and vehicle-mounted antitank weapons--is weighted based on its potential role in combat, using the tank as the standard. 2/ Table B-1 shows the various categories and their respective weights for the 1976 base case, and for the 1987 force. For 1976, the family of combat systems is weighted to the then-current main battle tank, the M60. For 1987, weapons are compared to the new M1. The changes shown in the 1987 weights relative to the 1976 base case reflect the anticipated advances in technology and doctrine: the FVS will add a 25-millimeter cannon and antitank missile, and the AH-64 will add a significant antitank capability.

Each category's contribution to total force-wide firepower is considered a function of its respective category weight and the number of effective weapons that existed in the force in the 1976 base case. (As a general rule, only the weapons in fighting units were counted.) The largest portion (more than 80 percent) of the firepower assets in the 1976 baseline force was represented by the categories of tank and artillery because of the sheer numbers fielded and the respective category weights.

For each weapons category, the increased effectiveness of each new system is examined. Similar weapons systems within a given category are

---

1. See U.S. Department of Defense, Report to the Congress on U.S. Conventional Reinforcements for NATO (June 1976).

2. Other categories of weapons not considered in this analysis include air defense artillery, mortars, and small arms and machine guns.

TABLE B-1. ANALYTICAL WEIGHTS FOR U.S. WEAPONS SYSTEMS

Category	Baseline a/ System	Baseline a/ Weight	1987 System	1987 Weight
Tanks	M-60	1.0	M1	1.0
Armored Personnel Carriers	M-113	0.1	FVS	0.35
Artillery	Self-Propelled	1.1	MLRS	1.1
Attack Helicopters	AH-1G	0.2	AH-64	0.5
Antitank Weapons (Vehicle Mounted)	TOW Mounted on Jeep	0.4	Improved TOW Vehicle	0.4

SOURCE: Congressional Budget Office.

a. The 1976 base case includes the M60A1 tank, the M113 armored personnel carrier, which mounts a 50 caliber machine gun, and the AH-1G Cobra helicopter, which carries a 7.62-millimeter machine gun.

compared in terms of firepower, mobility, and survivability. 3/ Each new system was evaluated, usually against the weapon that was being replaced in the 1976 baseline force. 4/ In addition, any modifications to the weapons in the 1976 baseline force were assessed for their improvements in terms of force effectiveness. For example, the introduction of the thermal

3. Within each category of weapons, the performance characteristics are weighted differently. For example, the tank is weighted as follows: 45 percent firepower, 25 percent mobility, and 30 percent survivability. On the other hand, the category of field artillery receives 60 percent firepower, 25 percent mobility, and 15 percent survivability. The weights used in this analysis were compiled from Army data in Weapons Effectiveness Indices/Weighted Unit Values III.

4. In the case of the MLRS, for which there is no comparable weapon currently in the force, the baseline weapon that was used in the analysis was the eight-inch self-propelled howitzer.

imaging sight for night/poor weather combat on the M60A3 tank enhanced the firepower capabilities of the system relative to the baseline tank, the M60A1. In those instances in which the category weights changed, the improvements in the individual weapons systems' effectiveness were computed as part of the change in the category weights. In the case of the AH-64, the change in the category weight was a result of a TOW antitank missile's being mounted on the Cobra helicopter (AH-1G). Therefore, the improvements in performance characteristics in the AH-64 were measured against the Cobra-TOW helicopter. Table B-2 shows both the contribution by category to the total U.S. force capability and the improvements in effectiveness of the new systems over the 1976 baseline force used in this analysis.

TABLE B-2. U.S. WEAPONS EFFECTIVENESS IMPROVEMENTS

Weapons System Category	Percentage Change Improvement	Percentage Contribution to Total Firepower
Tanks		
M60A1 (baseline)	100	39
M60A3	108	
M-1	138	
Armored Personnel Carriers		
M113 (baseline)	100	4
FVS	350	
Artillery		
Self-propelled 8-inch (baseline)	100	48
MLRS	169	
Attack Helicopter		
AH-1G (baseline)	100	2
AH-1S	250	
AH-64	400	
Vehicle-Mounted Antitank Weapon		
Jeep-mounted TOW (baseline)	100	7
Improved TOW vehicle	150	

SOURCE: Congressional Budget Office.

Thus, the overall improvement in the force capability is a function of the improvements in the effectiveness of the new weapons systems, their contribution by category to the total force, and the percentage of the force that will be modernized. These changes are then applied to the baseline 1980 force. The results appear as changes to the overall force ratios.

THE MODERNIZATION OF THE WARSAW PACT FORCES

If the Warsaw Pact continues to produce equipment at recently observed rates, the majority of the existing force structure that could confront NATO will be modernized by the late 1980s. Table B-3 illustrates that percentage of the 120-division force (by type of system) that could be modernized through 1987. These efforts could increase the capability (measured in terms of firepower) of the Warsaw Pact by approximately 26 percent as compared with the 1980 force. Such increases in force capabilities could retain the Warsaw Pact advantages throughout the decade.

This estimate is derived from an analysis that quantifies the improvements to the 120-division Pact force as a function of the contribution of each weapons category, the performance characteristics of new weapons, and the quantities of those systems that will be fielded. This analysis also takes into account the recent reorganization of Soviet divisions that included the addition of 500 tanks and 1,500 pieces of artillery. 5/

As a point of departure, the 1976 baseline force was used to estimate the contribution of each category of weapons to the total Warsaw Pact force. Again, it is assumed that the contribution to the force is a function of the respective category weights and the number of effective weapons. With the exception of the attack helicopter, the category weights that were used for the U.S. force in 1976 and 1987 were also applied to the Warsaw Pact. (In the 1976 baseline force, the Warsaw Pact had fielded an attack helicopter mounted with antitank missiles.) Table B-3 provides the estimates used in this analysis for the contribution of each category to the total force and the change in effectiveness of each weapons system.

This analysis shows that the majority of the improvements to Warsaw Pact capabilities will result from the continued fielding in relatively large numbers of tanks (principally, the T-72), and of the BMP armored personnel

---

5. See Richard Burt, "Soviets Said to Add to its Bloc Troops," The New York Times, June 8, 1980, page 4; and Anthony Cordesman, "NATO's Estimate of the Balance: The Meaning for U.S. Security Policy," Armed Forces Journal International (August 1982), pp. 48-58.

TABLE B-3. WARSAW PACT WEAPONS EFFECTIVENESS

Weapons System	Percentage Contribution in Total Firepower	Percent Change in Weapons System Effectiveness[a]
Tank	60	
T-72		19
T-80		27
Armored Personnel Carrier (BMP)	7	250
Artillery (Self-propelled)	33	36
Attack Helicopter [b]	0.3	41

SOURCE: Congressional Budget Office.

a/ The 1976 baseline includes the T-62 tank, the BTR-50 armored personnel carrier, towed artillery, and the HIND-A helicopter.

b/ There is no category weight change for Soviet helicopters, because in 1976, the Soviets had fielded an attack helicopter, the HIND-A, which carried four "Swatter" anti-tank missiles. See Jane's All the World's Aircraft 1980-81, pp. 202-203.

carrier. Relative to the baseline force (T-62), the improvements resulting from the fielding of the T-64 and T-72 are in the areas of increased firepower (incorporating an automatic loader with a 125-millimeter gun) and survivability (reportedly using better laminated armor). Further, the BMP offers significant enhancements through the incorporation of a 73-millimeter automatic-loaded gun that fires a rocket-assisted HEAT (High-Explosive Anti-Tank) round.

For the purposes of this analysis, it appears reasonable to assume that, for the next five years, the Warsaw Pact will continue to produce annually at roughly the same rates as have been in evidence over the past five years. The annual production rates used in this analysis include: 3,260 tanks, 2,500 BMP armored personnel carriers, 700 pieces of self-propelled

artillery, and 180 HIND Attack Helicopters. 6/ It is also assumed that the Pact will continue to introduce limited quantities of new systems during the period, such as the T-80 tank.

As in the case of the United States' force capabilities, the overall improvements in the Warsaw Pact force is a function of the improvements in the effectiveness of the new weapons systems, their contribution by category to the total force, and the percentage of the force that will be modernized. These changes are then applied to the baseline 1980 force and appear as changes to the overall force ratios.

Analytical Limitation of Force Ratios--Tactical Aircraft

The force ratios used to measure the relative military balance between NATO and the Warsaw Pact do not take into account the effects of either side's tactical air forces. Current analytical methods for assessing the impact of tactical air forces combined with ground forces rely on extremely large and complex computer models that seek to simulate the outcome of combat. In addition to their unwieldly size, these models are sensitive to modeling assumptions and, as such, are "scenario dependent" in of their results. As a substitute, this study considers the quantity and quality of the opposing air forces, as well as their vulnerability to the side's ground-based air defense systems. Table B-4

TABLE B-4. NATO AND WARSAW PACT TACTICAL AIRCRAFT, 1981

	NATO	Warsaw Pact
Fighter, Ground Attack	3,833	4,820
Interceptor	572	1,490

SOURCE: From International Institute for Strategic Studies, The Military Balance 1981-1982.

6. This information has been compiled from a variety of unclassified sources, including U.S. Department of Defense, Soviet Military Power (Fall 1981), p. 12-13; Jane's All the World's Aircraft 1980-1981, pp. 202-203; Jane's Armor and Artillery 1981-1982, pp. 403-405.

compares the air forces of NATO and the Warsaw Pact. Though the Pact has a significant advantage in fighter interceptors, there appears to be rough parity in the numbers of ground attack aircraft. It is generally accepted that NATO has qualitatively superior air forces; however, it is not clear that these qualitative advantages could overcome the Pact's numerical advantages in interceptors and air defense systems. Though such a comparison fails adequately to assess either the contribution of tactical air support or its effect on ground combat, it does indicate that tactical air support is unlikely to alter theater-wide comparisons used here to evaluate ground combat forces.

APPENDIX C. THE MODERNIZATION EFFORTS OF THE NON-U.S. NATO ALLIES

THE BRITISH CORPS

In peacetime, the British Army of the Rhine (BAOR) consists of 55,000 troops organized into four armored divisions, one field force, and one artillery division. Upon mobilization, the corps could grow to more than 120,000 personnel with the addition of reserve units. The British Army is currently equipped with 900 Chieftain tanks that mount a 120-millimeter gun. In addition to 100 pieces of 105-millimeter artillery, the Britons have recently begun the deployment of the FH-70 155-millimeter towed howitzer.

The planned improvements in armor and anti-armor capabilities include equipping four armored BAOR regiments with the new Challenger tank. Compared with the current Chieftain tank, which has been in service almost 20 years, this new design has several advantages: it incorporates a new power pack, Chobham-type armor, and a laser rangefinder. The British plan to upgrade the remaining Chieftain tanks by adding night sights. Anti-armor improvements include the arming of the Lynx helicopter with eight TOW anti-tank missiles; the Lynx currently is equipped with 2.75-inch rockets, twin 7.62-millimeter machine gun pods, and a 20-millimeter cannon. Finally, the British plan to continue to upgrade their inventory of self-propelled artillery through the procurement of additional U.S.-built M109 155-millimeter self-propelled howitzers, as well as the SP70 155-millimeter self-propelled howitzers.

THE WEST GERMAN CORPS

The West Germans have recently completed a major reorganization of their Army and are aggressively pursuing a modernization program for equipment.

The German Field Army has a personnel strength of 272,000, which is organized in three corps. 1/ The 12 divisions are divided into six armored, four armored infantry, one mountain and one airborne. The new organization now has 17 armored brigades (as compared with 16) and 15 armored infantry brigades (as compared with 12). At present, the German

1. In addition, the Territorial Army consists of 38,000 troops.

Army's tank inventory consists of 2,400 Leopard Is, 1,200 M48A2s, and 150 Leopard IIs. The main armored fighting vehicle is the Marder, with an inventory of more than 2,100. The German artillery consists of several types of self-propelled (such as more than 580 M109 155-millimeter howitzers) and towed pieces (such as 164 FH-70 155-millimeter howitzers). In addition, the Germans maintain more than 200 LARS 110-millimeter multiple rocket launchers.

Future plans include the additional procurement of the Leopard II that is armed with a 120-millimeter smooth-bore gun. By fiscal year 1987 funded delivery period, 76 percent of all armored battalions will be equipped with the Leopard II. The Germans also plan to buy more FH-70 155-millimeter towed howitzers and to replace their 175-millimeter guns with improved 203-millimeter howitzers.

THE DUTCH CORPS

The Dutch corps relies most heavily on reinforcement to bring its two active divisions up to full wartime strength. At present, there is one Dutch armored brigade stationed in Germany; five active brigades (one armored and four mechanized infantry) are located in the Netherlands. Four additional brigades also could be available upon a call-up of reserves.

The Dutch forces are now equipped with more than 450 Leopard I and approximately 340 Centurion tanks--a World War II tank armed with a 105-millimeter gun. The Dutch plan to replace the tank with the new Leopard II; they have already ordered more than 400 Leopard II main battle tanks. The modernization of the fleet of armored personnel carriers has been completed. The Dutch have fielded more than 850 U.S-built Armored Infantry Fighting Vehicles (AIFV), which use a U.S. M113 chassis, incorporating a turret, and mounts a 25-millimeter cannon. In addition, the Dutch army has ordered more than 170 improved TOW vehicle kits that will be mounted on the AIFV. 2/

The Dutch army is also modernizing its artillery assets. Most significant is the replacement and upgrading of AMX 105-millimeter and M107 203-millimeter artillery with M109 155-millimeter and M110A2 203-

---

2. The Dutch have an option to order an additional 170 Improved TOW Vehicle kits to be mounted on AIFVs. See "AUSA 79: Crash Programs to Counter Deployed Soviet Armor," International Defense Review, Volume 13, No. 1/1980, p. 121.

millimeter artillery, respectively. 3/ Furthermore, the Dutch plan to purchase almost 150 U.S.-made M198 155-millimeter towed howitzers.

THE BELGIAN CORPS

The Belgian corps appears to be the weakest on NATO's Central Front today. It contains 25,000 personnel organized into one armored and one mechanized infantry brigade. Since 1976, the size of the peacetime corps stationed in Germany has been reduced by 7,000 personnel, returning one mechanized infantry brigade and one division headquarters to Belgium. Upon mobilization, the Belgians could field a two-division combat force for the corps.

The major item of equipment to be modernized by the Belgians is the armored personnel carrier. To replace more than 1,000 obsolete vehicles (such as the M-75 and AMX-VCI), the Belgians have ordered more than 500 AIFVs; more than 500 M113 armored personnel carriers; and 80 BDX armored personnel carriers. The latter is a fully amphibious vehicle that can mount a turret and can fire the Milan antitank guided missile.

No current plans exist for the modernization of the tank fleet or the artillery inventory. The Belgian Army has more than 330 Leopard I tanks in its active units; the reserves maintain 55 M-47 tanks (1950s vintage). The Belgian army primarily relies upon the light 105-millimeter self-propelled artillery for direct support. These howitzers are 20 years old and have a lesser effective range and lower burst radius per projectile than the 155-millimeter howitzers that are standard throughout NATO's armies. 4/

---

3. Both the AMX 105-millimeter and the M107 175-millimeter howitzers represent 1950s technology.

4. The 105-millimeter howitzer has an effective range of 11.5 kilometers and a burst radius of 35 meters; the 155-millimeter howitzer has an effective range of 18 kilometers and a burst radius of 50 meters.

APPENDIX D. ESTIMATING ARMY FORCE STRUCTURE REQUIREMENTS

To modernize the force, the U.S. Army must provide materiel for the active and reserve combat forces as well as for the training base, the maintenance float, and the war reserve stocks. The actual requirements and the detailed break-out of the numbers of weapons needed to fill the structure are classified; thus, the CBO estimated the requirements based on unclassified information. All divisions are assumed to have three brigades (four divisions have a round-out brigade in the Reserve Component). Table D-1 provides the requirements for some major systems. The methodology and assumptions used to develop these estimates are provided in this appendix.

- To estimate the requirements for the active combat forces in both the continental United States and Europe, the table of organization and equipment (TO&E) for the heavy division 86 configuration was used. The CBO assumed that all armored and mechanized infantry divisions (and brigades) would be configured under this organization as they received the new equipment. [1]

TABLE D-1. WEAPONS NEEDED TO FILL ASSUMED U.S. FORCE STRUCTURE

System	U.S. Army forces in Europe	Continental United States	Subtotal	Training Base
M1	1,656	1,814	3,470	176
FVS	1,864	2,305	4,169	208
AH-64	226	574	800	40

SOURCE: Congressional Budget Office.

1. Data provided by the Department of the Army.

- To build the requirements for the training base, it is estimated that 5 percent of the weapons needed to fill the active combat units would be required. 2/

- The maintenance float includes those weapon systems that constitute the operational ready float and the repair cycle float. It is assumed that 17 percent of the weapons systems that are needed to fill the active combat units and the training base would be required for the maintenance float. 3/

- War reserve stocks are those items of equipment required to sustain combat until factories can provide replacements. The levels of war reserve stocks are based on war plans and deployment schedules, as well as various assumptions regarding the intensity of combat. (To estimate the inventory levels for the tank, it is assumed that 51 percent of the requirements for the Active combat force would satisfy inventory levels for 180 days. 4/ To estimate the levels for the FVS, it is assumed that 37

TABLE D-1. (Continued)

Maintenance Float	War Reserve Stocks	Subtotal	Corps + 4 POMCUS	Total
630	1,672	5,014	1,060	7,013
774	1,542	6,036	1,220	7,913
143	0	983	210	1,193

NOTE: Total requirements include 618 DIVAD guns, 333 MLRS, and 578 applications of AHIP.

2, 3, 4. See Department of Defense Appropriations for 1978, Hearings before the House Committee on Appropriations, Subcommittee on Defense, Part 3, 95th Congress, 1st Session, pp. 34-37.

percent of the requirements for the active force would satisfy levels for 180 days.) [5]

- For the requirements of POMCUS stocks, it is assumed that a second set of equipment is required for all those active combat units assigned to the four division sets of POMCUS.

- The requirements for corps assets are estimated based on the Army's standard troop list for a corps. [6]

- Exceptions--Consistent with current Army plans, there are no war reserve stocks or POMCUS stocks for helicopters. The total requirements for DIVAD, AHIP, and MLRS were provided by the Department of the Army. No detailed breakout was estimated.

---

5. Based on Army data; see Army Modernization Information Memorandum, August 1, 1981, pp. 1-25 through 1-28.

6. See U.S. Army Armor Reference Data, Volume II, Nondivisional Organizations, U.S. Army Armor School, Fort Knox, Ky., 1979, pp. 487-489.